A COMPETENT PERSON'S REPORT AND VALUATION REPORT ON THE MINERAL ASSETS OF METOREX (PTY) LTD IN THE DEMOCRATIC REPUBLIC OF CONGO AND THE REPUBLIC OF ZAMBIA

Prepared for

Jinchuan Group International Resources Co. Ltd


Report Prepared by

SRK Consulting (South Africa) (Pty) Ltd

Project Number 453459

30 August 2013

(Effective date: 30 June 2013)

EXECUTIVE SUMMARY

[18.05(1), 18.09(2)(3), SV2.1]

ES1 Introduction

SRK Consulting (South Africa) (Pty) Ltd ("**SRK**") is an associate company of the international group holding company, SRK Global Limited (the "**SRK Group**"). SRK has been commissioned by Jinchuan Group International Resources Co. Ltd ("**Jinchuan**", also referred to as the "**Company**") to prepare a Competent Person's Report ("**CPR**") and Competent Valuation Report (**"CVR**") on the operations and projects of Metorex (Pty) Ltd ("**Metorex**") in the Democratic Republic of Congo ("**DRC**") and Republic of Zambia ("**Zambia**") according to the requirements of Chapter 18 of the Rules Governing the Listing of Securities on the Stock Exchange of Hong Kong Limited (respectively the "**Listing Rules**" and the "**HKSE**"). Both the CPR and CVR have been consolidated into this single report (the "**CPVR**").

ES2 Mineral Assets and Legal Status

[18.05(3), SV2.3]

Metorex is a private company registered in the Republic of South Africa and is a wholly-owned subsidiary of Jinchuan Group Company Limited. Metorex's interests in the operations and projects in the DRC and Zambia (collectively the "**Mineral Assets**") are as follows:

- Through its wholly-owned subsidiary Ruashi Holdings (Pty) Ltd ("**Ruashi Holdings**"), a 75% shareholding in Ruashi Mining sprl ("**Ruashi Mining**") near Lubumbashi in the DRC, which operates the Ruashi open pit mine producing Cu and Co (the "**Ruashi Mine**");
- An 85% shareholding in Chibuluma Mines plc ("**Chibuluma**"), near Kitwe in Zambia, which has the operating Chibuluma South underground mine producing Cu and the nearby Chifupu Project which forms part of the Chibuluma South licence. Chibuluma also holds a prospecting licence for the Chibuluma Central property;
- Through its effective stake in Kinsenda Copper Company sarl ("**KICC**"), a 77% shareholding in the Kinsenda Copper Project ("**Kinsenda**"), which is a brownfields underground mine under construction in the DRC;
- Via Ruashi Holdings and Ruashi Mining, an indirect 75% shareholding in the Musonoi Cu/Co Project ("**Musonoi**", also referred to as the Dilala East Project), near Kolwezi in the DRC, where a feasibility study is in progress; and
- Through its effective stake in KICC, a 77% shareholding in the Lubembe Copper Project ("**Lubembe**"), where a pre-feasibility study is in progress.

The title and rights to the Mineral Assets are summarised in Table ES1.

Table ES1: Metorex – summary of mineral rights

Licence	Type of Title	Area (ha)	Valid from	Expiry Date	Commodity
Ruashi					
PE578	Exploitation Permit	900	26 Sep 2001	25 Sep 2021	Cu, Co, base and precious metals
PE11751	Exploitation Permit	420	11 Dec 2009	10 Dec 2039	Cu, Co, base and precious metals
Chibuluma					
7064-HQ-LML Chibuluma West	Large-scale Mining Licence	4 895	6 Oct 1997	5 Oct 2022	Cu, Co, base and precious metals
7065-HQ-LML Chibuluma South	Large-scale Mining Licence	1 120	6 Oct 1997	5 Oct 2022	Cu, Co, base and precious metals
17314HQ-LPL Chibuluma Central	Large scale Prospecting licence	9 300	1 Feb 2013	31 Jan 2015	Cu, Co, Ni, Zn, Au
Kinsenda					
PE101	Exploitation Permit	4 928	6 Oct 2006	5 oct 2021	Cu, Co, Pb, Ni, Pd, W
PE12458	Exploitation Permit	5 695	10 Mar 2012	9 Mar 2042	Cu, Co, Ag, Ni, Pt, Au
Musonoi					
PE13083	Exploitation Permit	324	4 Dec 2012	3 Apr 2024	Cu, Co, Ni and Au
Lubembe					
PE330	Exploitation Permit	2 338	29 Jan 2002	28 Jan 2017	Cu, Co, Pb, Ni, Pd, W

The Mineral Assets are located in the DRC and Zambia within the Central African Copperbelt.

ES3 Overview of Mineral Assets

[18.05(3), SR1.2, SV2.3]

- **Ruashi Mine** – an open cast mine, processing approximately 1.4 Mtpa of RoM ore through a SX/EW processing plant, producing on average 38.5 ktpa of LME A-grade copper cathode and 4.5 ktpa of cobalt salt;
- **Chibuluma Mine** – an underground mine processing approximately 600 ktpa of RoM ore, producing a copper concentrate containing on average 16 ktpa of payable copper;
- **Kinsenda Project** – a brownfields underground project, which is planned to commence operations in 2015 at a processing rate of approximately 600 ktpa, producing sulphide and oxide concentrates which are expected to yield on average 24 ktpa of payable copper;
- **Musonoi Project** – a feasibility study for an underground mine is underway, scheduled to be completed in 2013. Planned plant feed is 70 ktpm, producing sulphide and oxide concentrates;
- **Lubembe Project** – a feasibility study for an open cast mine is underway, scheduled for completion in 2014. Planned plant feed through a SX/EW plant is 3.6 Mtpa, to produce LME-A grade copper cathode.

ES4 Material Change Statement

[18.05(2), SV2.9]

Based on information provided by the Company, no material change has occurred since the Effective Date to the resource and reserve statements or the values for the Mineral Assets at the date of publication of this CPVR (the "**Publication Date**").

ES5 Legal Claims or Proceedings

[18.05(4)]

SRK has been advised by the Company, its legal advisors and Metorex that there are no legal claims or proceedings which could influence Metorex's rights to explore and/or mine at the Mineral Assets.

ES6 Requirement and Reporting Standard

[18.29(1)(c), 18.34(1)]

The reporting standard adopted for the reporting of the Mineral Resources and Mineral Reserves for the Mineral Assets is the 2007 Edition of "*The South African Code for the Reporting of Exploration Results, Mineral Resources and Mineral Reserves (The **SAMREC Code**)*" as prepared by the South African Mineral Resource Committee Working Group under the auspices of the Southern African Institute for Mining and Metallurgy ("**SAIMM**") and the Geological Society of South Africa ("**GSSA**"). The SAMREC Code is an international reporting code that is acceptable to the Listing Rules [Rule 18.29(1)(c)].

The reporting standard adopted for the reporting of the values for the Mineral Assets is the 2008 Edition of "*The South African Code for the Reporting of Mineral Asset Valuation (The **SAMVAL Code**)*", as prepared by the South African Mineral Asset Valuation Working Group under the auspices of the SAIMM and the GSSA. The SAMVAL Code is an international valuation code that is acceptable to the Listing Rules [Rule 18.34(1)].

ES7 Reliance on SRK

[18.21, 18.23]

The CPVR is addressed to and may be relied upon by the Company, the Directors of the Company and the Company's various financial, legal and accounting advisors (the "**Advisors**") in support of the Proposed Transaction, specifically in respect of compliance with the requirements of the Listing Rules. SRK agrees that the CPVR may be made available to and relied upon by the Advisors.

SRK is responsible for the CPVR and for all the technical information in the circular released by the Company in connection with the Proposed Transaction and dated the same date as the CPVR (the "**Circular**") that has been extracted from this CPVR. SRK declares that it has taken all reasonable care to ensure that this CPVR and the technical information extracted from it and included in the Circular is, to the best of its knowledge, in accordance with the facts and contains no omission likely to affect its import.

SRK has no obligation or undertaking to advise any person of any development in relation to the Mineral Assets which comes to its attention after the date of the CPVR or to review, revise or update the CPVR or opinion in respect of any such development occurring after the date of the CPVR.

The Competent Person (CP) with overall responsibility for the CPVR and who has reviewed the Mineral Reserve estimates as reported by Metorex, is Mr Roger Dixon PrEng (Engineering Council of SA), who is Chairman and Corporate Consultant with SRK. Mr Dixon holds a BSc(Hons) degree in mining and is a Honorary Life Fellow of the SAIMM, which is a "*Recognised Professional Organisation"* ("**RPO**") as defined in Chapter 18 of the Listing Rules. Mr Dixon is a mining engineer with 40 years' experience in the mining industry, specialising in engineering studies, due diligence audits and mine valuation, and has supervised numerous engineering studies and due diligence reviews in Southern Africa and internationally during the past 10 years. He has had specific experience in Cu and Cu/Co projects in Zambia and the DRC for more than 10 years.

The CP who has reviewed the Mineral Resource estimates as reported by Metorex, is Mr Victor Simposya PrSciNat (South African Council of Natural and Scientific Professionals), a Member of the SAIMM, and a Partner with SRK with 32 years' experience in the mining industry. Mr Simposya holds a BSc (Min.Sci.) degree in geology from the University of Zambia and a MSc (Mining) from Montana Tech in Butte, Montana. He is a resource geologist who specialises in orebody computer modelling and geostatistical modelling, and has undertaken numerous mineral resource estimations and audits in Southern Africa and internationally during the past 10 years. Mr Simposya has more than 30 years' experience of the geology and resource estimation of Cu/Co projects in the Zambian and DRC Copperbelt. For 18 of these, he was based at ZCCM's Nchanga operations.

The Competent Evaluator (as defined in Chapter 18 of the Listing Rules) is Mr Andrew McDonald, an Associate Consultant with SRK holding a MSc degree in Geophysics (cum laude) from the University of the Witwatersrand and a MBL from UNISA. He is a registered Chartered Engineer (Engineering Council of UK, Reg. No. 334897) through the Institution of Materials, Minerals and Mining ("**IoM^3**") in London and is a Fellow of the SAIMM, both RPOs in terms of Chapter 18 of the Listing Rules. He has 39 years of diverse experience in a range of management, technical and financial activities in mining and light industrial industries, the past 18 of which have been involved in the fields of feasibility studies, due-diligence audits, financial evaluation and regulatory reporting for mineral projects throughout Africa and other international locations. He has undertaken numerous mineral property and project technical valuations during the past 14 years, specifically on Cu and Cu/Co projects in Zambia and the DRC since 2002.

SRK confirms that the presentation of information contained elsewhere in the Circular which relates to information in the CPVR is accurate, balanced and not inconsistent with the CPVR.

SRK believes that its opinion must be considered as a whole and selecting portions of the analysis or factors considered by it, without considering all factors and analyses together, could create a misleading view of the process underlying the opinions presented in this CPVR. The preparation of a CPVR is a complex process and does not lend itself to partial analysis or summary.

While SRK has exercised due care in reviewing the supplied information, SRK does not accept responsibility for finding any errors or omissions contained therein and disclaims liability for any consequences of such errors and omissions. SRK's assessment of the Mineral Resources and Mineral Reserves, TEP forecasts and Chapter 18 Value for the Mineral Assets is based on information provided by the Company and Metorex throughout the course of SRK's investigations, which in turn reflect various technical-economic conditions prevailing at the date of the CPVR. In particular, the Mineral Reserves, TEPs and Chapter 18 Value for the Mineral Assets are based on commodity prices and exchange rates prevailing at the Effective Date of this CPVR. These TEPs can change significantly over short periods of time.

This report includes technical information, which requires subsequent calculations to derive subtotals, totals and weighted averages. Such calculations may involve a degree of rounding and consequently introduce an error. Where such errors occur, SRK does not consider them to be material.

ES8 Independence

[18.22]

SRK will be paid a fee for this work at commercial rates in accordance with normal professional consulting practice. Payment of fees is in no way contingent upon the conclusions to be reached in the CPVR.

ES9 Effective Date and Valuation Date

[18.12, SR1.1(ii), SR1.1A(iii), SV2.9]

The effective date of the CPVR is 30 June 2013 (the "**Effective Date**"), which is co-incident with the Valuation Date.

The Mineral Resource and Mineral Reserve statements set out in this CPVR are reported as at 30 June 2013 and represent the resources and reserves at 30 June 2013 as audited by SRK.

The associated life-of-mine ("**LoM**") plans and associated technical and economic parameters ("**TEPs**") included in the LoM plans all commence on 1 July 2013.

ES10 Review Process

SRK has conducted a review (which specifically excludes independent verification by means of re-calculation) and assessment of all material technical issues likely to influence the future performance of the operating mines and development projects and the resulting TEPs, which includes the following:

- Inspection visits to the operations of Ruashi and Chibuluma and the development project of Kinsenda conducted during Q4 2012 and to the Musonoi and Lubembe projects in July 2013;
- Enquiry of key mine management and head office personnel during October 2012 to July 2013 in respect of the Mineral Assets, the resource and reserves statements, the LoM plans, the TEPs and other related matters;
- Examination of historical information for Ruashi and Chibuluma for the financial reporting periods ended 31 December 2010 (referred to as "**F2010**"), 31 December 2011 ("**F2011**"), 31 December 2012 ("**F2012**") and the six months from January to June 2013 ("**H1-F2013**")
- A review of the resource and reserve statements for the Mineral Assets. Whilst SRK has not re-estimated the Mineral Resources and Mineral Reserves, SRK has performed all necessary validation and verification procedures deemed appropriate to place reliance on such information;
- Reporting of the Mineral Resource and Mineral Reserve Statements based on the resources and reserves information provided by Metorex as at 30 June 2013;
- Examination, review and where appropriate modification of TEPs drawn from technical studies and LoM plans for the Mineral Assets, and all conclusions and recommendations drawn therefrom;
- Assessment of the reasonableness of the macro-economic and commodity price assumptions incorporated into the Mineral Resource and Mineral Reserve Statements, the TEPs and values for the Mineral Assets.

SRK confirms that it has performed all validation and verification procedures deemed necessary and/or appropriate by SRK in order to place an appropriate level of reliance on the technical information provided by Metorex and the Company.

ES11 Geology

[SR1.2A, SV2.5]

The Mineral Assets are located in the Central African Copperbelt, a strongly deformed, arcuate belt of rocks that extends from north-eastern Angola through southern DRC and into Zambia. The different nomenclature for the basal Roan Supergroup reflects not only the different geological history of the belt but also a lack of correlation across national boundaries. Consequently, two sub-types of stratiform, sediment-hosted copper ("**SSC**") deposits are distinguished in the rocks of the Central African Copper belt. These are divided on geographical lines into a northwest district in the DRC ("**Congolese Copper belt**") and a southeast district in Zambia ("**Zambian Copper belt**").

Mineralisation in both Zambia and the DRC is largely restricted to the Lower Roan Group, although vein style mineralisation is locally important higher in the succession (e.g. Kansanshi, Kipushi, Dikulushi).

Historically, mining at Ruashi focussed on near surface oxide copper in the form of malachite and chrysocolla mineralisation. The High Grade ("**HG**") oxides formed a 30 m to 60 m supergene mineralisation blanket in the saprolitic rock close to surface, overlying the primary sulphide ore bodies.

Mineralisation in the Chibuluma South orebody is predominantly Cu with very minor Co and is hosted in detrital conglomerates, sandstones and argillaceous siltstones of the Lower Roan Group.

Kinsenda is a copper only sulphide orebody consisting of predominantly chalcocite, bornite and chalcopyrite mineralisation hosted in detrital conglomerates, sandstones and argillaceous siltstones of the Lower Roan Group.

The mineralised zones at Musonoi consist of talc shales, breccias and siltstones forming part of the meta-sedimentary sequence. Copper and cobalt mineralisation is generally in the form of malachite and heterogenite/kolwezite in the oxide portion of the deposit and chalcocite, bornite and carrollite in the deeper sulphide zone. The depth of oxidation is approximately 220 m below surface.

Copper mineralisation at Lubembe occurs mainly as finely disseminated malachite with some azurite and chrysocolla, whilst cobalt mineralisation occurs as rare heterogenite. Within the sulphide zone (generally below 200 m), copper mineralisation is mainly in the form of finely disseminated chalcocite, with some chalcopyrite, minor bornite and pyrite.

ES12 Mineral Resources and Mineral Reserves

[18.18, 18.19, 18.29(1)(c), SR1.1A(iii), SR8B(i), SV2.6]

Summaries of the Mineral Resources and Mineral Reserves for the various Mineral Assets, estimated and classified in accordance with the SAMREC Code at 30 June 2013, are set out in Table ES2 to Table ES6 below.

The Mineral Resources are quote inclusive of the Mineral Reserves.

Table ES2: Ruashi Mine – SRK Audited Mineral Resources and Mineral Reserves at 30 June 2013 at 0.78% Cu or 0.62% Co cut-off

Resource Classification	Mineral Resources (@ 0.78% Cu or 0.62% Co cut-off) Tonnes (Mt)	Cu Grade (%)	Copper (kt)	Co Grade (%)	Cobalt (kt)	Reserve Classification	Mineral Reserves (@1.23% CuEq cut-off) Tonnes (Mt)	Cu Grade (%)	Copper (kt)	Co Grade (%)	Cobalt (kt)
Oxide Material						**Oxide Material (in LoM Plan)**					
Measured	0.7	4.71	34.7	0.26	1.9	Proved	0.3	6.12	19.7	0.26	0.8
Indicated	15.7	2.22	348.3	0.37	57.4	Probable	12.7	2.59	329.7	0.46	58.5
Inferred	6.6	1.07	71.1	0.13	8.4						
Total Oxide Resources	**23.0**	**1.97**	**454.1**	**0.29**	**67.6**	**Total Reserves**	**13.1**	**2.68**	**349.4**	**0.45**	**59.3**
Sulphides											
Indicated	2.9	1.78	51.7	0.44	12.8						
Inferred	7.3	2.98	219.3	0.29	21.0						
Total Sulphide Resources	**10.3**	**2.64**	**270.9**	**0.33**	**33.8**						
Oxides + Sulphides Material											
Measured	0.7	4.71	34.70	0.26	1.90						
Indicated	18.6	2.15	400.0	0.38	70.2						
Total Measured and Indicated	19.3	2.25	434.7	0.37	72.1						
Inferred	14.0	2.08	290.4	0.21	29.4						
Total Mineral Resources	**33.3**	**2.18**	**725.0**	**0.30**	**101.4**	**Total Mineral Reserves**	**13.1**	**2.68**	**349.4**	**0.45**	**59.3**

Table ES3: Chibuluma South including Chifupu – SRK Audited Mineral Resource and Mineral Reserve statement at 30 June 2013 at a 1% TCu cut-off

Classification	Mineral Resources			Classification	Mineral Reserves		
	Tonnes (Mt)	TCu grade (%)	Contained Cu (kt)		Tonnes (Mt)	TCu grade (%)	Contained Cu (kt)
Chibuluma				**Chibuluma**			
Measured	1.6	3.99	63.8	Proved	1.4	3.06	43.6
Indicated	1.2	4.34	52.0	Probable	0.9	3.95	35.4
Inferred	0.7	4.55	31.9				
Sub-Total Chibuluma	**3.5**	**4.22**	**147.7**	**Sub-Total Chibuluma**	**2.3**	**3.41**	**79.0**
Chifupu underground				**Chifupu underground**			
Measured				Proved			
Indicated	1.3	2.68	34.8	Probable	1.1	2.12	22.4
Inferred	0.9	2.41	21.7				
Sub-Total Chifupu	**2.2**	**2.57**	**56.5**	**Sub-Total Chifupu**	**1.1**	**2.12**	**22.4**
Total Chibuluma/Chifupu	**5.7**	**3.58**	**204.2**	**Total Chibuluma/Chifupu**	**3.4**	**3.01**	**101.4**

Table ES4: Kinsenda – SRK Audited Mineral Resources and Mineral Reserves at 30 June 2013

Classification	Mineral Resources (1.5% Cu cut-off)			Classification	Mineral Reserves (@ 3.5% Cu cut-off)		
	Tonnes (Mt)	Cu grade (%)	Copper (kt)		Tonnes (Mt)	Cu grade (%)	Copper (kt)
Measured	0.0	0.00	0.0	Proved			
Indicated	13.5	5.25	711.1	Probable	6.1	4.80	293.1
Inferred	7.5	5.96	445.6				
Total Kinsenda	**21.0**	**5.51**	**1 156.6**	**Total Kinsenda**	**6.1**	**4.80**	**293.1**

Table ES5: Musonoi Est – SRK Audited Mineral Resources for Dilala East at 30 June 2013 at a 1.6% Cu cut-off grade

Classification	Tonnage **(Mt)**	**Cu grade (%)**	**Copper (kt)**	Co grade **(%)**	Cobalt **(kt)**
Measured	13.0	3.27	424.4	0.92	118.9
Indicated	13.9	2.36	328.2	0.92	127.2
Inferred	4.8	2.52	120.6	0.87	41.4
Total	**31.7**	**2.76**	**873.2**	**0.91**	**287.6**

Table ES6: Lubembe – SRK Audited Mineral Resource Estimate at 30 June 2013 at 1.15% Cu cut-off

Resource classification	Tonnage (Mt)	% TCu	Cu metal contained, (kt)
Measured	-	-	-
Indicated	54.0	1.88	1 015.8
Inferred	36.6	2.08	761.4
Total	**90.6**	**1.96**	**1 777.2**

Mineral Reserves represent the tonnes fed to the plant, at the reported head grade of the plant feed.

High level summaries of the Mineral Resources and Mineral Reserves at the Mineral Assets are set out in Tables ES7 and ES8 respectively.

Table ES7: Metorex – Summary of Audited Mineral Resource Estimates at 30 June 2013

Classification	Tonnage (Mt)	Cu grade (%)	Copper (kt)	Co grade (%)	Cobalt (kt)
Ruashi Mine					
Measured	0.7	4.71	34.70	0.26	1.90
Indicated	18.6	2.15	400.0	0.38	70.2
Inferred	14.0	2.08	290.4	0.21	29.4
Total Ruashi Mine	**33.3**	**2.18**	**725.0**	**0.30**	**101.4**
Chibuluma South Mine including Chifupu					
Measured	1.6	3.99	63.8		
Indicated	2.5	3.47	86.8		
Inferred	1.6	3.35	53.6		
Total Chibuluma South (including Chifupu)	**5.7**	**3.58**	**204.2**		
Kinsenda Project					
Measured	0.0	0.00	0.0		
Indicated	13.5	5.25	711.1		
Inferred	7.5	5.96	445.6		
Total Kinsenda Project	**21.0**	**5.51**	**1 156.6**		
Musonoi Project					
Measured	13.0	3.27	424.4	0.92	118.9
Indicated	13.9	2.36	328.2	0.92	127.2
Inferred	4.8	2.52	120.6	0.87	41.4
Total Musonoi Project	**31.7**	**2.76**	**873.2**	**0.91**	**287.6**
Lubembe Project					
Measured	-	-	-		
Indicated	54.0	1.88	1 015.8		
Inferred	36.6	2.08	761.4		
Total Lubembe Project	**90.6**	**1.96**	**1 777.2**		
Total Metorex					
Measured	15.3	3.41	522.9	0.79	120.8
Indicated	102.5	1.49	2 541.9	0.19	197.4
Inferred	64.5	2.59	1 671.5	0.11	70.8
Total Metorex Resources	**182.3**	**2.04**	**4 736.3**	**0.21**	**388.9**

Table ES8: Metorex – Summary of Audited Mineral Reserve Estimates at 30 June 2013

Classification	Tonnage (Mt)	Cu grade (%)	Copper (kt)	Co grade (%)	Cobalt (kt)
Ruashi Mine					
Proved	0.3	6.12	19.7	0.26	0.8
Probable	12.7	2.59	329.7	0.46	58.5
Total Ruashi Mine	**13.05**	**2.68**	**349.4**	**0.45**	**59.3**
Chibuluma South Mine including Chifupu					
Proved	1.4	3.06	43.6		
Probable	1.9	2.96	57.8		
Total Chibuluma South (including Chifupu)	**3.4**	**3.01**	**101.4**		
Kinsenda Project					
Proved					
Probable	6.1	4.80	293.1		
Total Kinsenda Project	**6.1**	**4.80**	**293.1**		
Total Metorex					
Proved	1.7	3.63	63.4	0.05	0.8
Probable	20.8	3.27	680.6	0.28	58.5
Total Metorex Reserves	**22.5**	**3.30**	**743.9**	**0.26**	**59.3**

ES13 Reconciliation of Mineral Resources and Mineral Reserves

[SR8B(iv), SR8C(vi)]

Previous Mineral Resource and Mineral Reserve statements for the Mineral Assets were published by Metorex in its Annual Report for 2011. A reconciliation of the changes from the Mineral Resources and Mineral Reserves at 31 December 2011 to 30 June 2013 is provided as follows:

- Ruashi Mine (Table ES9);

- Chibuluma Mine (Table ES10);
- Kinsenda (Table ES11);
- Musonoi (Table ES12);
- Lubembe (Table ES13).

Table ES9: Ruashi – Mineral Resources and Mineral Reserves Reconciliation - 31 December 2011 to 30 June 2013

Item	At Jun 2013 Tonnes (Mt)	At Jun 2013 Contained Metal Cu (kt)	At Jun 2013 Contained Metal Co (kt)	At Dec 2011 Tonnes (Mt)	At Dec 2011 Contained Metal Cu (kt)	At Dec 2011 Contained Metal Co (kt)	Comments
Mineral Reserves							
Proved	0.3	19.7	0.8	0.7	37.0	2.0	1) Mined 1.28 Mt in F2012 and 0.81 Mt in H1-F2013
Probable	12.7	329.7	58.5	14.6	407.0	64.0	2) Different cut-off grade
Total Min. Reserves	13.1	349.4	59.3	15.3	444.0	66.0	
Mineral Resources							
Measured	0.7	34.7	1.9	1.0	46.3	2.6	1) Mined 1.28 Mt in F2012 and 0.81 Mt in H1-F2013
Indicated	18.6	400.0	70.2	25.5	562.4	99.4	2) Different cut-off grade
Inferred	14.0	290.4	29.4	23.1	385.3	47.5	3) Deep drilling changed geological interpretation of sulphide extent
Total Min. Resources	33.3	725.0	101.4	49.6	993.9	149.4	

Table ES10: Chibuluma – Mineral Resources and Mineral Reserves Reconciliation - 31 December 2011 to 30 June 2013

Item	At Jun 2013 Tonnes (Mt)	At Jun 2013 Contained Metal Cu (kt)	At Dec 2011 Tonnes (Mt)	At Dec 2011 Contained Metal Cu (kt)	Comments
Mineral Reserves					
Proved	1.4	43.6	1.7	61.0	1) Mined 0.56 Mt in F2012 and 0.27 Mt in H1-F2013
Probable	2.0	57.8	1.2	46.0	2) Chifupu reserves added
Total Min. Reserves	3.4	101.4	2.9	107.0	
Mineral Resources					
Measured	1.6	63.8	3.9	141.9	1) Mined 0.56 Mt in F2012 and 0.27 Mt in H1-F2013
Indicated	2.5	86.8	2.3	87.1	2) Changed classification by SRK
Inferred	1.6	53.6	0.4	10.0	
Total Min. Resources	5.7	204.2	6.6	239.0	

Table ES11: Kinsenda – Mineral Resources and Mineral Reserves Reconciliation - 31 December 2011 to 30 June 2013

Item	At Jun 2013 Tonnes (Mt)	At Jun 2013 Contained Metal Cu (kt)	At Dec 2011 Tonnes (Mt)	At Dec 2011 Contained Metal Cu (kt)	Comments
Mineral Reserves					
Proved					
Probable	6.1	293.1	9.1	412.0	1) Changed geological interpretation
Total Mineral Reserves	6.1	293.1	9.1	412.0	2) Removal of Inferred Mineral Resources included in the LoM plan
Mineral Resources					
Measured	0.0	0.0	0.0	0.0	1) Changed geological interpretation
Indicated	13.5	711.1	29.7	905.2	2) Different cut-off grade
Inferred	7.5	445.6	17.2	564.2	
Total Min. Resources	21.0	1 156.6	46.9	1 469.4	

Table ES12: Musonoi - Mineral Resources and Mineral Reserves Reconciliation - 31 December 2011 to 30 June 2013

Item	At Jun 2013 Tonnes (Mt)	At Jun 2013 Contained Metal Cu (kt)	At Jun 2013 Contained Metal Co (kt)	At Dec 2011 Tonnes (Mt)	At Dec 2011 Contained Metal Cu (kt)	At Dec 2011 Contained Metal Co (kt)	Comments
Mineral Reserves	-			-			**None declared**
Mineral Resources							
Measured	13.0	424.4	118.9	10.6	345.6	92.8	1) Additional drilling increased resource base
Indicated	13.9	328.2	127.2	8.3	279.2	71.6	2) Different cut-off grade
Inferred	4.8	120.6	41.4	3.5	111.1	32.0	3) Changed classification by SRK
Total Min. Resources	31.7	873.2	287.6	22.5	735.9	196.4	

Table ES13: Lubembe – Mineral Resources and Mineral Reserves Reconciliation - 31 December 2011 to 30 June 2013

Total Resources	At Jun 2013 Tonnes (Mt)	At Jun 2013 Contained Metal Cu (kt)	At Dec 2011 Tonnes (Mt)	At Dec 2011 Contained Metal Cu (kt)	Comments
Mineral Reserves	-		-		None declared
Mineral Resources					
Measured	0.0	0.0	0.0	0.0	1) Different cut-off grade
Indicated	54.0	1 015.8	56.5	1 039.6	
Inferred	36.6	761.4	36.6	761.4	
Total Min. Resources	90.6	1 777.2	93.1	1 800.9	

ES14 Capital Expenditure

There are two main capital projects within the Mineral Assets during the first two and a half years, i.e. H2-F2013 to F2015. These relate to the establishment of the access and underground infrastructure for Chifupu (part of Chibuluma) and the establishment of an underground mine, plant and associated surface infrastructure at Kinsenda. The capital requirements for Chifupu and Kinsenda for H2-F2013 to F2015 are set out in Table ES14. Also included in Table ES14 are the capital expenditure budgets (in real terms) for Ruashi and Chibuluma (excluding Chifupu), which are aimed at improving the performance of existing plants, replacement of mining equipment and underground development (Chibuluma).

Table ES14: Capital Expenditure (real terms)

Item	Units	H2-F2013	F2014	F2015
Capital Projects				
Chifupu project capital	(USDm)	2.5	3.8	7.8
Kinsenda project capital	(USDm)	70.5	182.2	42.9 (1)
Operating Mines				
Ruashi	(USDm)	32.6	25.3	9.8
Chibuluma (excl Chifupu)	(USDm)	9.6	17.9	11.4

1. Excluding sustaining capital (or stay-in business capital) in Table 5.22.

ES15 Operating Costs

The forecast operating costs (in real terms) for Ruashi, Chibuluma and Kinsenda are summarised in Tables ES15, ES16 and ES17 respectively.

Table ES15: Ruashi Forecast Operating Cost (real terms)

Cost Item	Unit	H2-F2013	F2014
Mining - ore	(USDm)	2.85	6.78
Mining - waste	(USDm)	3.46	21.63
Mining - other	(USDm)	5.97	11.47
Ore rehandling costs	(USDm)	1.41	2.82
SX-EW process	(USDm)	36.90	71.10
SX-EW engineering	(USDm)	5.69	11.44
Co process	(USDm)	18.27	33.16
Co engineering	(USDm)	0.39	0.79
Operating Cost	(USDm)	74.95	159.18
General & Administration			
Salaries and wages	(USDm)	15.63	28.99
Administrative costs	(USDm)	7.59	15.19
Consulting fees	(USDm)	1.86	5.03
SHEC	(USDm)	1.71	3.20
Total Production Cost	(USDm)	101.75	211.59
Realisation/off-mine costs	(USDm)	15.42	28.27
Royalties	(USDm)	8.57	17.27
Social spend	(USDm)	3.33	6.08
Cash Cost	**(USDm)**	**129.06**	**263.22**
Unit cost	(USD/t RoM)	121.23	104.23
	(USD/t plant feed)	183.29	186.81

Table ES16: Chibuluma Forecast Operating Cost (real terms)

Cost Item	Unit	H2-F2013	F2014
Mining	(USDm)	3.75	7.70
Mining engineering	(USDm)	4.44	8.84
Transport costs - Chifupu ore	(USDm)	0.00	0.05
Processing	(USDm)	3.32	6.96
Surface engineering	(USDm)	0.37	0.75
Power	(USDm)	1.03	2.06
Operating Cost	(USDm)	12.91	26.35
General & Administration			
Salaries and wages	(USDm)	8.13	16.26
Administrative costs	(USDm)	1.80	3.60
Consulting fees	(USDm)	1.24	2.47
SHEC	(USDm)	0.63	1.27
Production Cost	(USDm)	24.71	49.95
Realisation/off-mine costs	(USDm)	8.29	16.52
Royalties	(USDm)	4.52	9.00
Cash Cost	**(USDm)**	37.52	75.48
Unit Cost	(USD/t RoM)	133.40	134.57

It should be noted that production at Kinsenda only starts in F2015. Prior to this, there are effectively no operating costs while construction is underway as all costs are capitalised.

Table ES17: Kinsenda Forecast Operating Cost (real terms)

Cost Item	Unit	F2015	F2016
Mining	(USDm)	21.10	22.70
Mineral processing	(USDm)	7.52	9.04
Operating Cost	(USDm)	28.62	31.74
General & Administration			
Salaries and wages	(USDm)	14.15	14.15
Administrative costs	(USDm)	4.08	4.08
Production Cost	(USDm)	46.84	49.96
Realisation/off-mine costs - sulphides	(USDm)	27.40	32.76
Realisation/off-mine costs - oxides	(USDm)	5.21	6.30
Royalties	(USDm)	3.40	4.07
Cash Cost	**(USDm)**	82.85	93.10
Units Cost	(USD/t RoM)	163.73	153.11

ES16 Environmental Liabilities

[18.05(6)(e), SR5.2]

The key environmental issues at the Mineral Assets are as follows:

- **Ruashi**:
  - Whilst Metorex has increased the financial provision for post-closure water treatment, the closure cost estimate may not adequately provide for long term water treatment, re-profiling of dumps, remediation of contaminated soil and enforcement of social costs related to community expectations;
  - Management of ground and surface water resources is a key environmental challenge facing the mine;
  - The lack of topsoil stockpiles for rehabilitation is a key environmental risk;
- **Chibuluma**:
  - Metorex may be liable for environmental damage at Chibuluma East not caused by Chibuluma, in which case the closure costs may be understated;
  - Whilst Metorex has increased the financial provision for post-closure water treatment, the possibility that on-going water treatment may be required in the post closure scenario and that closure liabilities may be greater that the provision suggested, remain a risk;
- **Kinsenda:**
  - Several of the mitigatable impacts identified by the Social Impact Assessment have the potential to become unacceptable if poorly managed;
  - The closure costs are not based on a definitive closure plan and SRK notes that no allowance was made for post closure decant of contaminated water;
- **Musonoi**:
  - Due to over 100 years of mining activity in the Kolwezi area, the area may have been impacted by a lowering of the water table or dust fall out from neighbouring mines. If not adequately defined, the closure cost for the project may be much higher than initially estimated. SRK understands that Metorex is busy with an environmental base line study;
  - The principal environmental issues relating to a new mine will be the potential impact on land use, biodiversity, water resources and air quality. Mitigation measures will be addressed in the Environmental Plan which is in progress;
- **Lubembe**:
  - Significant potential for environmental degradation and AMD;
  - Securing additional real estate for waste rock dump and tailings facilities;
  - A settlement of some 50 houses, comprising 400 to 500 people, will have to be relocated. A number of social risks are identified in the social scan report, many of them very typical for mining operations in the area and it is clear that expectation management, resettlement planning, especially in the light of the proximity of the residential area to the mine, and acceptable implementation of the Corporate Social Initiatives will be critical.

ES17 Sufficiency of Rehabilitation Funding

[18.05(6)(d)]

Metorex reviews the closure cost estimates for the operations on an annual basis. SRK has reviewed these and adjusted the closure costs where appropriate.

The total environmental liabilities of the Mineral Assets amount to a total of USD84.8 million which are expended upon closure of the various mines. Of this, USD47.1 million is attributed to bio-physical closure and USD37.7 million is attributed to terminal benefits.

Metorex has a group-wide provision for post-closure water treatment of around USD5 million. In SRK's experience, this figure is likely to be considerably more. In the absence of any proper evaluation of the extent (quantities) and severity (pH or TDS) of water to be treated, SRK has in agreement with Metorex increased this provision for post closure water treatment to USD25 million for the group for evaluation purposes. The additional provision does not eliminate this risk, but it reduces the potential financial impact on the company significantly.

ES18 Previous Valuations

[SV2.12]

Jinchuan Group Co. Ltd purchased Metorex for USD1.356 billion in July 2011. This was the value of the deal on the date the offer was made, rather than the actual price paid which decreased due to movement in the ZAR:USD exchange rate. This effectively represents a market value for Metorex in 2011 of this amount.

SRK is not aware of any other valuations of Metorex that have appeared in the public domain in the last two years.

ES19 Chapter 18 Value

[18.30(3)]

The Chapter 18 Value for Metorex and the Mineral Assets on a sum-of-the-parts basis is presented in Table ES18.

In accordance with Chapter 18 of the Listing Rules, SRK has not included any consideration of Inferred Mineral Resources in determining the Chapter 18 Value for the Mineral Assets. The exclusion of these sources of potential value as well as the exclusion of a premium or discount relative to market, strategic or other consideration, means that the Chapter 18 Value does not reflect a Fair Market Value.

Table ES18: Metorex Summary Value

Item	Selected Value (USDm)	Net Debt (USDm)	Metorex Loans (USDm)	Equity Value (USDm)	Metorex Interest (%)	Value to Metorex (USDm)
Operations						
Ruashi	577.2	-41.7	-215.8	319.7	75.0%	455.6
Chibuluma	109.5	-17.8	0.0	91.7	85.0%	77.9
Kinsenda	174.0	0.0	-174.0	0.0	77.0%	174.0
Projects						
Musonoi	311.0				75.0%	233.3
Lubembe	208.6				77.0%	160.6
Ruashi Sulphides	18.8				75.0%	14.1
Sub-total	1 3992.0					1 115.6
Adjustments						
Metorex Head Office	-26.7	-9.0 (1)				-35.7
Hedge contracts - mark to market						None in force
Musonoi Feasibility Study costs						Incl in Ruashi capex
Lubembe Feasibility Study costs	-7.8					-7.8
Environmental liabilities						included in cash flows
Terminal value of plant & equipment						
Ruashi	40.4				75.0%	30.3
Chibuluma	12.5				85.0%	10.6
Kinsenda	18.6				77.0%	14.3
Net Metorex Value						1 127.3

1 Net cash on hand at 30 June 2013.

The net attributable Chapter 18 Value for the Mineral Assets on a sum-of-the-parts basis is estimated at USD1 127 million.

ES20 Principal Risks and Opportunities

The principal technical risks which impact on the Mineral Resource statements and the Chapter 18 Value for Metorex and the Mineral Assets are summarised in Section 10.2 of this CPVR.

Specific Risks

- Potential Water-related issues - the long-term dewatering and discharge requirements, extent of contamination of water and potential impact of dewatering on other water users;
- Potential for increased closure costs, especially the ongoing treatment of contaminated water after mine closure;
- Ban on the export of sulphide concentrates or increased export taxes;

- If Kinsenda (and Musonoi) is prevented from treating its sulphide concentrates at CCS, additional capital would have to be sourced to cater for a more complex plant design;
- Increased stockholding levels to cater for delays in delivery of diesel and plant consumables.

Specific Opportunities

The principal opportunities with respect to the Mineral Assets are:

- Increase in Mineral Resources through exploration of open ended deposits and identification of new deposits;
- Power supply becomes more stable and reliable;
- Supply of SO_2 and acid improves;
- Increase in Mineral Reserves through upgrading of Inferred Mineral Resources and completion of technical studies which demonstrate that the treating of sulphide concentrates is both technically feasible and economically viable;
- Reduce the unknowns surrounding environmental closure liabilities by undertaking thorough surface and ground water investigations.

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30 August 2013

A COMPETENT PERSON'S REPORT AND VALUATION REPORT ON THE MINERAL ASSETS OF METOREX (PTY) LTD IN THE DEMOCRATIC REPUBLIC OF CONGO AND THE REPUBLIC OF ZAMBIA

1 INTRODUCTION

1.1 Background

[18.05(1), 18.09(2)(3), SR1.1A(ii), SR1.5A(1), SV2.2, SV2.3]

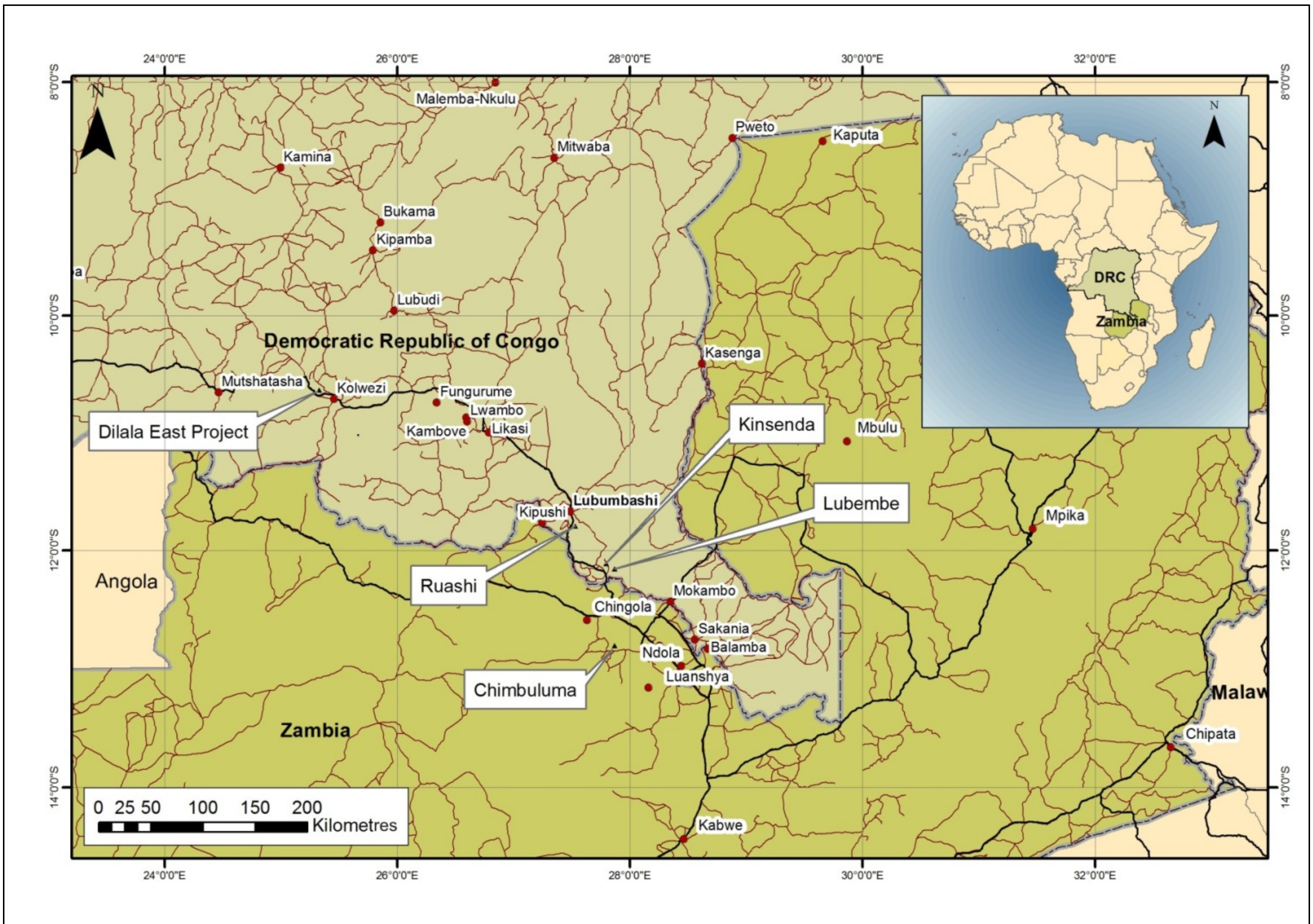
SRK Consulting (South Africa) (Pty) Ltd ("**SRK**") is an associate company of the international group holding company, SRK Global Limited (the "**SRK Group**"). SRK has been commissioned by Jinchuan Group International Resources Co. Ltd ("**Jinchuan**", also referred to as the "**Company**") to prepare a Competent Person's Report ("**CPR**") and Competent Valuation Report ("C**VR**") on the operations and projects of Metorex (Pty) Ltd ("**Metorex**") in the Democratic Republic of Congo ("**DRC**") and Republic of Zambia ("**Zambia**") according to the requirements of Chapter 18 of the Rules Governing the Listing of Securities on the Stock Exchange of Hong Kong Limited (respectively the "**Listing Rules**" and the "**HKSE**"). Both the CPR and CVR have been consolidated into this single report (the "**CPVR**").

Metorex is a private company registered in the Republic of South Africa and is a wholly-owned subsidiary of Jinchuan Group Company Limited. Metorex's interests in the operations and projects in the DRC and Zambia (collectively the "**Mineral Assets**") are as follows:

- Through its wholly-owned subsidiary Ruashi Holdings (Pty) Ltd ("**Ruashi Holdings**"), a 75% shareholding in Ruashi Mining sprl ("**Ruashi Mining**") near Lubumbashi in the DRC, which operates the Ruashi open pit mine producing Cu and Co (the "**Ruashi Mine**");
- An 85% shareholding in Chibuluma Mines plc ("**Chibuluma**"), near Kitwe in Zambia, which has the operating Chibuluma South underground mine producing Cu. The nearby Chifupu Project forms part of the Chibuluma South licence. Metorex was awarded the Chibuluma Central prospecting licence in January 2013;
- Through its effective stake in Kinsenda Copper Company sarl ("**KICC**"), a 77% shareholding in the Kinsenda Copper Project ("**Kinsenda**"), which is a brownfields underground mine under construction in the DRC;

- Via Ruashi Holdings and Ruashi Mining, an indirect 75% shareholding in the Musonoi Cu/Co Project ("**Musonoi**", also referred to as the Dilala East Project), near Kolwezi in the DRC, where a feasibility study is in progress; and
- Through its effective stake in KICC, a 77% shareholding in the Lubembe Copper Project ("**Lubembe**"), where a pre-feasibility study is in progress.

The location of the Mineral Assets in the DRC and Zambia is shown in Figure 1.1.



srk consulting	**Metorex** Locality Plan of Metorex's Mineral Assets in the DRC and Zambia	Project No. 453459

Figure 1.1: Metorex – locality map of Metorex's Mineral Assets in the DRC and Zambia

1.2 Corporate Structure of Metorex

The corporate structure of Metorex is set out in Figure 1.2.

Ruashi Holdings is a South African registered wholly-owned subsidiary of Metorex. Ruashi Holdings has a 75% interest in Ruashi Mining, a private limited liability company registered in the DRC. The remaining 25% of Ruashi Mining is held by Générale des Carrières et des Mines ("**Gécamines**"), a state owned mining company registered in the DRC. Ruashi Mining holds 100% interests in the Ruashi Mine and Musonoi Project.

Metorex has an 85% interest in Chibuluma, which has as its main operating asset the Chibuluma South mine. The Chibuluma East and Chibuluma West mines are now depleted, but Chibuluma remains liable for environmental rehabilitation. The remaining 15% interest is held by Zambia Consolidated Copper Mines Investment Holdings plc ("**ZCCM-IH**") and the Government of Zambia ("**GRZ**"). The Chifupu Project, located approximately 1.7 km southwest of Chibuluma South mine, forms part of the Chibuluma South mine licence.

Copper Resources Corporation ("**CRC**") is a British Virgin Islands registered, 100% owned subsidiary of Metorex. CRC has a 72.15% interest in KICC, a private limited liability company registered in the DRC. Metorex owns a direct 4.85% of KICC. The remaining 23% of KICC is held by Société de Développement Industriel et Miniere du Congo ("**Sodimico**"), a state owned mining company registered in the DRC. KICC holds 100% interests in Kinsenda, Lubembe and Kinsenda exploration permit.

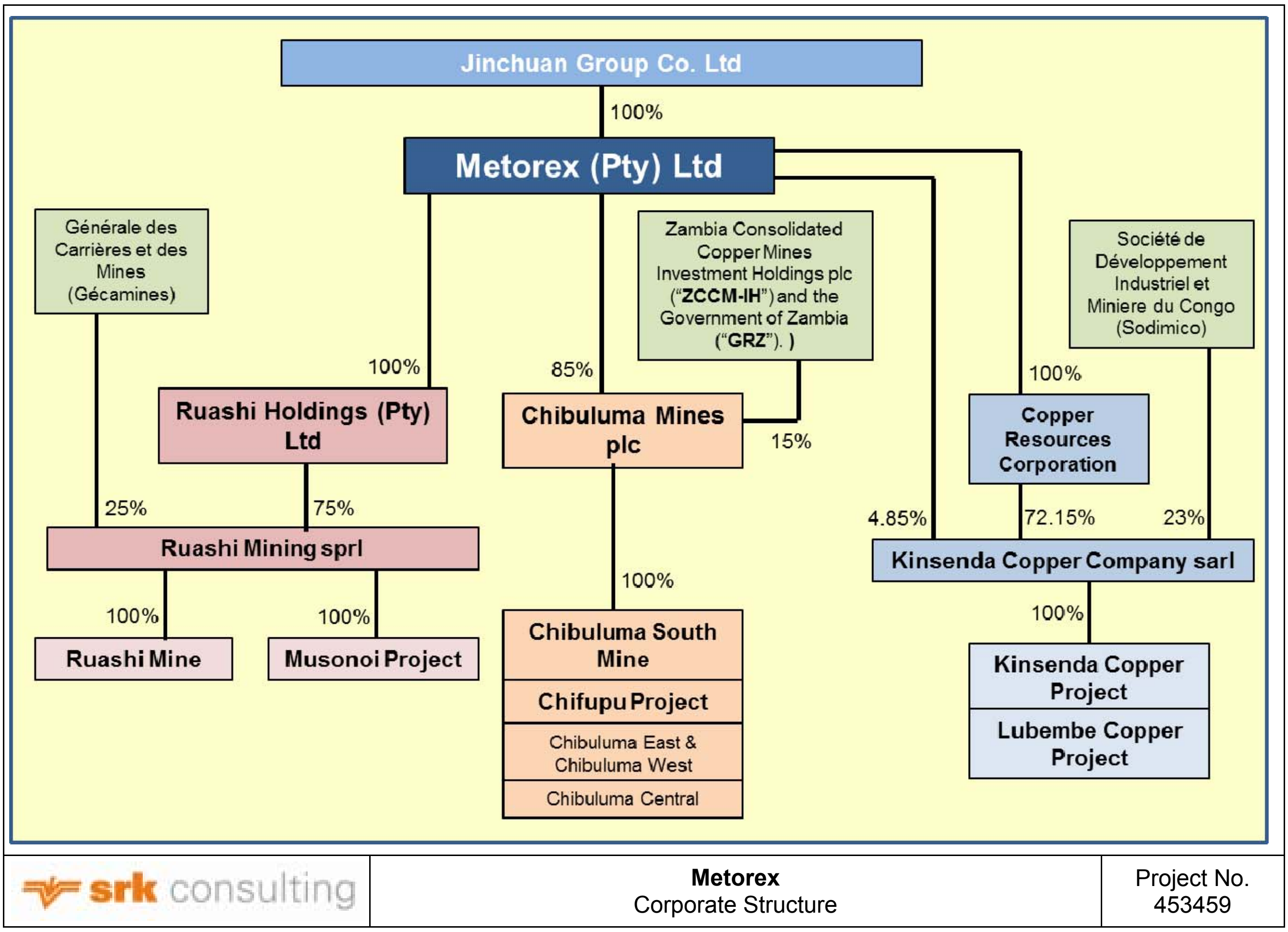


Figure 1.2: Metorex – corporate structure

1.3 Terms of Reference

[18.05(1), 18.09(2)(3)]

Jinchuan requires a CPR and a CVR to be compiled on Metorex's Mineral Assets as prerequisite documents for a proposed transaction as required by the Listing Rules (the "**Proposed Transaction**"). The combined CPVR for inclusion in the Prospectus, Admission Document, Circular or similar document (the "**Circular**") in support of the Company's Proposed Transaction to the HKSE must satisfy the reporting requirements of the Listing Rules, in particular Chapter 18 – Mineral Companies.

1.4 Reporting Compliance, Reporting Standard and Reliance

1.4.1 Reporting Compliance

[SR1.1A(iii), SV2.13]

SRK confirms that this CPVR complies with the disclosure and reporting requirements of the Listing Rules, including:

- Rules 18.09 to 18.13 inclusive, relating to relevant notifiable transactions involving the acquisition or disposal of mineral assets;
- Rules 18.18, 18.19, 18.21, 18.22, 18.23, 18.24, 18.25, 18.26, and 18.30, relating to statements on Mineral Resources and Mineral Reserves;
- Rule 18.28, 18.29 and 18.34, relating to the applicable reporting standard; and
- Guidance Note 7 to the Listing Rules, titled "Suggested Risk Assessment for Mineral Companies" [Rule 18.05(5)].

SRK understands the requirements set out in the Listing Rules with regards to the qualifications and experience of the Independent Competent Person and Competent Evaluator. SRK confirms that the staff employed on the project satisfies these requirements of the HKSE Listing Rules [Rules 18.21, 18.22 and 18.23].

1.4.2 Reporting Standard

[18.24(3), 18.29, 18.34, SR1.1, SV2.2]

The reporting standard adopted for the reporting of the Mineral Resources and Mineral Reserves for the Mineral Assets is the 2007 Edition of "*The South African Code for the Reporting of Exploration Results, Mineral Resources and Mineral Reserves (The **SAMREC Code**)*" as prepared by the South African Mineral Resource Committee Working Group under the auspices of the Southern African Institute for Mining and Metallurgy ("**SAIMM**") and the Geological Society of South Africa ("**GSSA**"). The SAMREC Code is an international reporting code that is acceptable to the HKSE Listing Rules [Rule 18.29(1)(c)].

The reporting standard adopted for the reporting of the values for the Mineral Assets is the 2008 Edition of "*The South African Code for the Reporting of Mineral Asset Valuation (The **SAMVAL Code**)*", as prepared by the South African Mineral Asset Valuation Working Group under the auspices of the SAIMM and the GSSA. The SAMVAL Code is an international valuation code that is acceptable to the HKSE Listing Rules [Rule 18.34(1)].

1.4.3 Reliance

The CPVR is addressed to and may be relied upon by the Company, the Directors of the Company and the Company's various financial, legal and accounting advisors (the "**Advisors**") in support of the Proposed Transaction, specifically in respect of compliance with the requirements of the Listing Rules. SRK agrees that the CPVR may be made available to and relied upon by the Advisors.

SRK is responsible for the CPVR and for all the technical information in the circular released by the Company in connection with the Proposed Transaction and dated the same date as the CPVR (the "**Circular**") that has been extracted from this CPVR. SRK declares that it has taken all reasonable care to ensure that this CPVR and the technical information extracted from it and included in the Circular is, to the best of its knowledge, in accordance with the facts and contains no omission likely to affect its import.

SRK confirms that the presentation of information contained elsewhere in the Circular which relates to information in the CPVR is accurate, balanced and not inconsistent with the CPVR.

SRK believes that its opinion must be considered as a whole and selecting portions of the analysis or factors considered by it, without considering all factors and analyses together, could create a misleading view of the process underlying the opinions presented in this CPVR. The preparation of a CPVR is a complex process and does not lend itself to partial analysis or summary.

SRK has no obligation or undertaking to advise any person of any development in relation to the Mineral Assets which comes to its attention after the date of the CPVR or to review, revise or update the CPVR or opinion in respect of any such development occurring after the date of the CPVR.

1.5 Effective Date

[18.24(2), SR1.1A(ii), SR5.7C(iii), SV2.9]

The effective date of the CPVR is 30 June 2013 (the "**Effective Date**").

The Mineral Resource and Mineral Reserve statements set out in this CPVR are reported as at 30 June 2013 and represent the resources and reserves at 30 June 2013 as audited by SRK.

The associated life-of-mine ("**LoM**") plans and associated technical and economic parameters ("**TEPs**") included in the LoM plans all commence on 1 July 2013.

The values for the Mineral Assets are taken to be correct at 30 June 2013, the Effective Date of the CPVR, which is also the **Valuation Date**.

1.5.1 Material Change

[18.05(2), SR1.1A(ii), SR5.7C(iii), SV2.9]

Based on information provided by the Company and Metorex, the events that have occurred since the Effective Date are unlikely to have a material impact on the resource and reserve statements or the values for the Mineral Assets at the date of publication of this CPVR (the "**Publication Date**").

1.5.2 Legal Claims and Proceedings

[18.05(4)]

SRK has been advised by the Company and its legal advisors that there are no legal claims or proceedings which could influence Metorex's rights to explore and/or mine at the Mineral Assets. From a list of legal proceedings and outstanding liabilities provided by the Company and Metorex, SRK could not find any outstanding issues that could influence Metorex's rights or prevent it from continuing with its operations.

1.5.3 Sufficiency of Rehabilitation Funding

[18.05(6)(d)]

Metorex reviews the closure cost estimates for the operations on an annual basis. SRK has reviewed these and adjusted the closure costs where appropriate.

Metorex has a group-wide provision for post-closure water treatment of around USD5 million. In SRK's experience, this figure is likely to be considerably more. In the absence of any proper evaluation of the extent (quantities) and severity (pH or TDS) of water to be treated, SRK has in agreement with Metorex increased this provision for post closure water treatment to USD25 million for the group for evaluation purposes.

1.5.4 Claims over land

[18.05(6)(h)]

Metorex has advised SRK that there are no land claims that may exist over the land on which exploration or mining activity is being carried out. From a list of outstanding liabilities provided by the Company and Metorex, SRK could not find any outstanding claims that could materially influence Metorex's rights or prevent it from continuing with its operations.

1.6 Verification and Validation

[SV2.14]

SRK has conducted a review (which specifically excludes independent verification by means of re-calculation) and assessment of all material technical issues likely to influence the future performance of the operating mines and development projects and the resulting TEPs, which included the following:

- Inspection visits to the Mineral Assets as follows:
  - Ruashi 18 and 24 October 2012;
  - Chibuluma 15, 16 and 22 October 2012;
  - Chifupu 9 July 2013;
  - Kinsenda 17 and 23 October 2012;
  - Lubembe 30 July 2013;
  - Musonoi 31 July 2013.
- Enquiry of key mine management and head office personnel during October 2012 to July 2013 in respect of the Mineral Assets, the resource and reserves statements, the LoM plans, the TEPs and other related matters;
- Examination of historical information for Ruashi and Chibuluma for the financial reporting periods ended 31 December 2010 (referred to as "**F2010**"), 31 December 2011 ("**F2011**"), 31 December 2012 ("**F2012**"), and the six months from January to June of 2013 ("**H1-F2013")**;
- A review of the resource and reserve statements for the Mineral Assets. Whilst SRK has not re-estimated the Mineral Resources and Mineral Reserves, SRK has performed all necessary validation and verification procedures of the source data, sampling methods, QA/QC methods applied, geological database, geological modelling and resource classification criteria deemed appropriate to place reliance on such information and to satisfy itself that the resource estimates are valid;
- Reporting of the Mineral Resource and Mineral Reserve Statements based on the resources and reserves provided by Metorex as at 30 June 2013;
- Examination, review and where appropriate modification of TEPs drawn from technical studies and LoM plans for the Mineral Assets, and all conclusions and recommendations drawn there from;

- Assessed the reasonableness of the macro-economic and commodity price assumptions incorporated into the Mineral Resource and Mineral Reserve Statements, the TEPs and values for the Mineral Assets.

SRK confirms that it has performed all validation and verification procedures deemed necessary and/or appropriate by SRK in order to place an appropriate level of reliance on the technical information provided by Metorex and the Company.

In presenting the Mineral Resource and Mineral Reserve Statements, the TEPs and values for the Mineral Assets in this CPVR, the following apply:

- Measured and Indicated Resources are inclusive of those Mineral Resources modified to produce Mineral Reserves, i.e. Mineral Resources are reported on an inclusive basis of the Mineral Reserves;
- In accordance with Chapter 18 of the Listing Rules, SRK has not included any consideration of Inferred Mineral Resources in determining the values of the Mineral Assets. The exclusion of these sources of potential value as well as exclusion of a premium or discount related to market, strategic or other considerations, means that the values assigned to the Mineral Assets do not reflect a Fair Market Value.

1.7 Limitations, Reliance on Information, Declaration, Consent and Cautionary Statements

1.7.1 Limitations

[SV2.10]

Mineral Reserve estimates are based on many factors, including data with respect to drilling and sampling. Mineral Reserves are derived from estimates of future technical factors, operating and capital expenditures, product prices and the exchange rate between the various currencies and the United States Dollar ("**USD**"). The Mineral Reserve estimates contained in this CPVR should not be interpreted as assurances of economic life of the Mineral Assets. As Mineral Reserves are only estimates based on the factors and assumptions described herein, future Mineral Reserve estimates may need to be revised. For example, if production costs increase or product prices decrease, a portion of the current Mineral Resources, from which the Mineral Reserves are derived, may become uneconomical to recover and would therefore result in lower estimated Mineral Reserves. Furthermore, should any of the assumed factors change adversely, the TEPs and values for the Mineral Assets as reported herein may need to be revised and may result in lower estimates.

This CPVR contains statements of a forward looking nature. These forward looking statements are estimates and involve a number of risks and uncertainties that may cause the actual results to differ materially from those anticipated in this CPVR.

The achievability of the projections, LoM plans, budgets and forecast TEPs as included in this CPVR is neither warranted nor guaranteed by SRK. The projections as presented and discussed herein have been proposed by Metorex management and have been adjusted where appropriate by SRK.

The projections cannot be assured as they are based on economic assumptions, many of which are beyond the control of the Company and Metorex. Future cash flows and profits derived from such forecasts are inherently uncertain and actual results may be significantly more or less favourable.

Unless otherwise expressly stated, all the opinions and conclusions set out in this CPVR are those of SRK.

1.7.2 Reliance on Information

SRK has relied upon the accuracy and completeness of technical, financial and legal information and data:

- furnished by or through the Company, including information and data originating with Metorex and the Company's Advisors; and
- in respect of all aspects relating to the Mineral Assets, publicly available information published by Metorex from time to time, including but not limited to any Mineral Resources and Mineral Reserve statements and technical studies contained in such information or data.

The Company has confirmed to SRK that, to its knowledge, the information provided by it to SRK was complete and not incorrect or misleading in any material aspect. SRK has no reason to believe that any material facts have been withheld.

Whilst SRK has exercised all due care in reviewing the supplied information, SRK does not accept responsibility for finding any errors or omissions contained therein and disclaims liability for any consequences of such errors or omissions.

The technical views in this CPVR are based on information provided by the Company, Metorex and the Company's Advisors throughout the course of SRK's investigations, which in turn reflect various technical-economic conditions prevailing at the date of this CPVR. In particular, the Mineral Reserves, TEPs and values of the Mineral Assets are based on expectations regarding commodity prices and exchange rates prevailing at the Effective Date of this CPVR. These can change significantly over relatively short periods of time. Should these change materially, the TEPs could be materially different in these changed circumstances.

SRK has reviewed the information provided by Metorex and is satisfied that the extents of the properties described in the various rights are consistent with the maps and diagrams received from Metorex. Nevertheless, this does not constitute a legal due diligence and SRK does not make any claim or state any opinion as to the validity of Metorex's title to the mineral rights or surface rights held or purported to be held over Mineral Assets.

This CPVR includes technical information, which requires subsequent calculations to derive subtotals, totals and weighted averages. Such calculations may involve a degree of rounding and consequently introduce an error. Where such errors occur, SRK does not consider them to be material.

1.7.3 Declaration

[18.22, SR11A(ii), SV2.2, SV2.14]

SRK will be paid a fee for this work at commercial rates in accordance with normal professional consulting practice. Payment of fees is in no way contingent upon the conclusions to be reached in the CPVR.

Neither SRK nor any of its employees or associates employed in the compilation of the CPVR of the Mineral Assets, nor any of the Competent Persons and/or Competent Evaluators who are responsible for authoring this CPVR, nor any directors of SRK have at the date of this report, nor have had within the previous two years, any shareholding in the Company, Metorex, the Mineral Assets or the Company's Advisors, or any other any pecuniary, economic or beneficial interest, or the right to subscribe for such interest, whether direct or indirect, in the Company, Metorex, the Mineral Assets, any of the Company's Advisors or the outcome of the work.

Consequently, SRK, the Competent Persons and the Competent Evaluators consider themselves to be independent of the Company and Metorex, their respective directors, senior management and the Company's Advisors.

In this CPVR, SRK provides assurances to the Board of Directors of the Company, in compliance with the requirements of the reporting standards, that the Mineral Reserves and Mineral Resources, TEPs, including production profiles, operating expenditures and capital expenditures for the Mineral Assets, as provided to SRK by the Company and reviewed and where appropriate modified by SRK, are reasonable given the information currently available.

1.7.4 Consent

[18.13]

In compliance with Rule 18.13 of the Listing Rules, SRK has given and has not withdrawn its written consent for the inclusion in the Circular of this CPVR as set out in Appendix V of the Circular and all of the information contained in the Circular which has been extracted directly from this CPVR.

1.7.5 Cautionary Statements

[18.08]

The reader and any potential or existing shareholder or investor in the Company or Metorex is cautioned that Metorex is involved in exploration on the Mineral Assets and there is no guarantee that any unmodified part of the Mineral Resources will ever be converted into Mineral Reserves nor ultimately extracted at a profit.

1.7.6 Disclaimers and Cautionary Statements for US Investors

This CPVR uses the terms "Mineral Resource", "Measured Mineral Resource", "Indicated Mineral Resource" and "Inferred Mineral Resource". US shareholders and investors in the Company are advised that while such terms are recognised and permitted under the SAMREC Code and the Listing Rules, the US Securities and Exchange Commission ("**SEC**") does not recognise them and strictly prohibits companies from including such terms in SEC filings.

Accordingly, US investors and shareholders in the Company are cautioned not to assume that any unmodified part of the Mineral Resources in these categories will ever be converted into Mineral Reserves as such term is used in this CPVR.

1.8 Indemnities provided by the Company

The Company has provided the following indemnities to SRK:

- In the event that the Company discloses or distributes any SRK work product or other deliverable (including reports, analysis, opinion or similar) (the "**SRK Work Products**") to any third party, the Company shall procure that such third party complies *mutatis mutandis* with various of the Company's obligations to SRK that are contained in the engagement letter between the Company and SRK, and unless otherwise agreed in writing by SRK, no such third party shall be entitled to place reliance upon any information, warranties or representations which may be contained within the SRK Work Products and the Company shall indemnify SRK against all and any such claims, losses and costs which may be incurred by SRK arising from the breach by the Company of this obligation. This indemnity shall not apply in relation to the provision by the Company of drafts of this CPVR to the Company's Advisors and the HKSE and in relation to, or following, the public release of this CPVR in the Circular.
- The Company has confirmed to SRK that, to its knowledge, the information provided by it to SRK was complete and not incorrect or misleading in any material aspect. SRK has no reason to believe that any material facts have been withheld. Whilst SRK has exercised all due care in reviewing the supplied information, SRK does not accept responsibility for finding any errors or omissions contained therein and disclaims liability for any consequences of such errors or omissions.

1.9 Qualifications of Consultants, Competent Persons and Competent Evaluator

[18.21, 18.23, SR11A(i), SV2.13, SV2.14]

SRK is part of an international group (the SRK Group) that comprises more than 1 700 staff, offering expertise in a wide range of resource engineering disciplines. The SRK Group's independence is ensured by the fact that it holds no equity in any project and is totally owned by its employees. This permits SRK to provide its clients with conflict-free and objective recommendations on crucial judgement issues.

SRK has a demonstrated track record in undertaking independent assessments of resources and reserves, project evaluations and audits, Mineral Expert's Reports, Competent Person's Reports, Mineral Resource and Mineral Reserves Compliance Audits, Independent Valuation Reports and independent feasibility evaluations to bankable standards and valuation of mineral properties on behalf of exploration and mining companies and financial institutions world-wide. The SRK Group has also worked on a large number of major international mining operations and their projects, providing mining consultancy service inputs. SRK has specific experience in commissions of this nature.

This CPVR has been prepared based on a technical and economic review by a team of twelve consultants sourced from the SRK Group's offices in South Africa over an eight week period. These consultants are specialists in the field of geology, resource and reserve estimation and classification, open-pit and underground mining, geotechnical engineering, mineral processing, hydrogeology and hydrology, tailings management, infrastructure, environmental management and mineral asset valuation.

- Roger Dixon PrEng, FSAIMM, BSc(Hons), EDP — Mineral Reserves, Internal Review;
- Victor Simposya PrSciNat, MSAIMM, BSc, MSc — Geology and Mineral Resources;
- Alan Naismith PrSciNat, FSAIMM, FSANIRE, MSc, MBA — Rock Engineering;
- Gert Nel PrSciNat, MGSSA, MSc — Hydrogeology
- Mark Sturgeon PrEng, MSAIMM, BSc(Eng) — Open Pit Mining and Mineral Reserves;
- Marcin Wertz PrEng, FSAIMM, MMCC, BSc(Eng) — Underground Mining and Mineral Reserves;
- Carel Roode PrEng, MSAIMM, MMMMA, BSc(Hons), BCom — Metallurgical Processing;
- Rob McNeill PrTechEng, MSAICE, Nat.Dip (T4) — Tailings Storage and Logistics;
- Peter Shepherd PrSciNat, BSc(Hons) — Hydrology;

• Steve Owen CEng, MIMechE, BSc(Hons)	Infrastructure, Capital Expenditure, Occupational Health & Safety;
• Andrew Smithen PrEng, MSAIMM, MSAIAE, MSc(Eng), MBL	Environmental, Community/Social;
• Andrew McDonald CEng, MIMMM, FSAIMM, MSc, MBL	Technical Valuation and CPVR compilation; and
• Michael Warren MAusIMM, FAICD, BSc, MBA	External CPVR Review

The CPVR has been prepared under the direction of the Competent Person ("**CP**") who assumes overall professional responsibility for the document. The report, however, will be published by SRK, the commissioned entity, and accordingly SRK will assume responsibility for the views expressed therein. Consequently all references to SRK mean the CP and vice versa.

The CP with overall responsibility for the CPVR and who has reviewed the Mineral Reserve estimates as reported by Metorex, is Mr Roger Dixon PrEng (Engineering Council of SA), who is Chairman and Corporate Consultant with SRK. Mr Dixon holds a BSc(Hons) degree in mining and is a Honorary Life Fellow of the SAIMM, which is a "*Recognised Professional Organisation*" ("**RPO**") as defined in Chapter 18 of the Listing Rules. Mr Dixon is a mining engineer with 40 years' experience in the mining industry, specialising in engineering studies, due diligence audits and mine valuation, and has supervised numerous engineering studies and due diligence reviews in Southern Africa and internationally during the past 10 years. He has had specific experience in Cu and Cu/Co projects in Zambia and the DRC for more than 10 years.

The CP who has reviewed the Mineral Resource estimates as reported by Metorex, is Mr Victor Simposya PrSciNat (South African Council of Natural and Scientific Professionals), a Member of the SAIMM, and a Partner with SRK with 32 years' experience in the mining industry. Mr Simposya holds a BSc (Min.Sci.) degree in geology from the University of Zambia and a MSc (Mining) from Montana Tech in Butte, Montana. He is a resource geologist who specialises in orebody computer modelling and geostatistical modelling, and has undertaken numerous mineral resource estimations and audits in Southern Africa and internationally during the past 10 years. Mr Simposya has more than 30 years' experience of the geology and resource estimation of Cu/Co projects in the Zambian and DRC Copperbelt. For 18 of these, he was based at ZCCM's Nchanga operations.

The Competent Evaluator (as defined in Chapter 18 of the Listing Rules) is Mr Andrew McDonald, an Associate Consultant with SRK holding a MSc degree in Geophysics (cum laude) from the University of the Witwatersrand and a MBL from UNISA. He is a registered Chartered Engineer (Engineering Council of UK, Reg. No. 334897) through the Institution of Materials, Minerals and Mining ("**IoM3**") in London and is a Fellow of the SAIMM, both RPOs in terms of Chapter 18 of the Listing Rules. He has 39 years of diverse experience in a range of management, technical and financial activities in mining and light industrial industries, the past 18 of which have been involved in the fields of feasibility studies, due-diligence audits, financial evaluation and regulatory reporting for mineral projects throughout Africa and other international locations. He has undertaken numerous mineral property and project technical valuations during the past 14 years, specifically on Cu and Cu/Co projects in Zambia and the DRC since 2002.

2 MARKET OVERVIEW AND COMMODITY PRICES

[SR5.7C, SR5.8A/C, SV2.18]

2.1 Introduction

The following section provides a brief overview of the supply and demand dynamics for Cu and Co, historical commodity prices and assumptions regarding future commodity prices as these affect the value for the Mineral Assets per Chapter 18 of the Listing Rules (the "**Chapter 18 Value**"). The information as presented here has been sourced from various public domain information databases including internet sources.

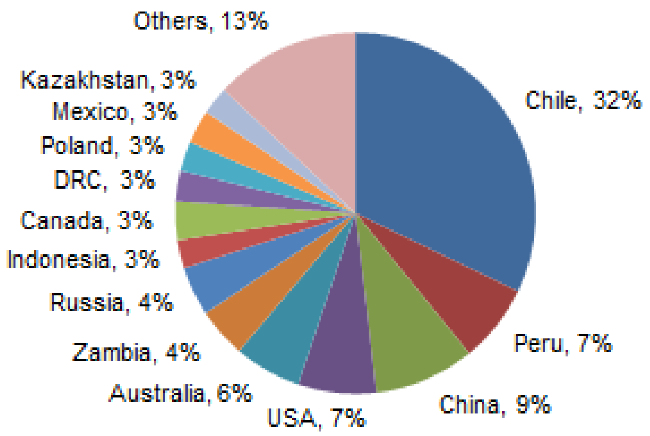
This section is presented for information only and should not be considered a substitute for a detailed forecast demand-supply price analysis in respect of commodity prices.

2.2 Market Overview

2.2.1 Supply and Demand for Copper

Copper is used in a wide variety of applications, with building construction being the single largest market, followed by electronics and electronic products, transportation, industrial machinery, and consumer and general products. It is being used extensively in 'green' technologies, such as solar cells and electric vehicles, and its antimicrobial properties are used to reduce the transfer of germs and disease.

World mine copper production totalled 17.0 Mt in 2012 according to the USGS Survey, with 70% of production arising from seven countries. South America was the dominant regional producer, with Chile and Peru accounting for 32% and 7% of world production in 2012 respectively, as set out in Figure 2.1.



Metorex
World Copper Mine Production in 2012 (source: USGS Mineral Commodity Summaries)

Project No. 453459

Figure 2.1: World Copper Mine Production in 2012

World refined copper production and usage trends for 2006 to 2012 are summarised in Table 2.1. Expectations for major growth in Chilean production in 2012 were not achieved, with year-on-year world production only growing by 2.8% relative to 2011. Global usage for refined copper grew 5.5% in 2012 relative to the same period in 2011 (see Table 2.1). Production of refined copper grew by only 1.7%, thereby creating a drawdown in global supplies.

Table 2.1: World refined copper production and usage trends – 2006 to 2012

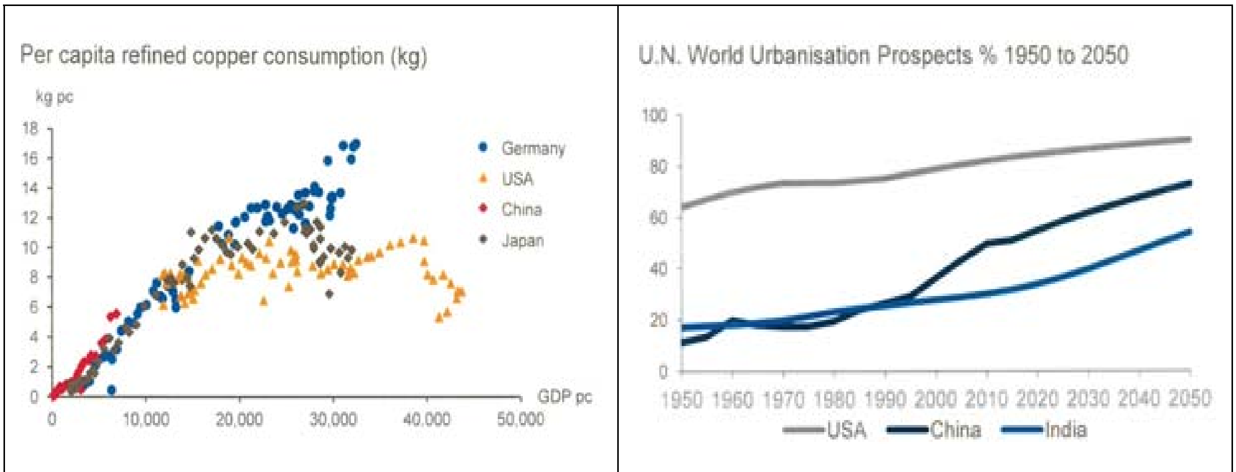
Item	Units	2006	2007	2008	2009	2010	2011	2012
World Mine Production	(Mt)	14.99	15.49	15.53	15.90	16.02	16.02	16.74
World refined production	(Mt)	17.29	17.93	18.24	18.27	19.00	19.65	20.12
World refined usage	(Mt)	17.03	18.20	18.05	18.07	19.35	19.87	20.47

The outlook for copper is focused mainly on China and India, which are forecast to make up 50% of demand by 2020:

- Projections suggest that by 2025, 220 Chinese cities will have over 1 million inhabitants. This will translate into an increased demand for buildings and transit systems, with 5 million buildings and 170 transit systems projected to be constructed by 2025. Ultimately, whether it is more people, more buildings, or more infrastructure, more copper will be needed to facilitate construction.

  However, one of the largest drivers of copper will be the growth of the Chinese consumer. More consumers, means more demand for cars, appliances, garments, and electronics (see Figure 2.2). China has set a goal of 65% urbanization rate by 2050, which translates into 300 million rural residents becoming urban residents over this time period (see Figure 2.2). Evidence of these implications can be seen in copper consumption figures between 1980 and 2010: copper consumption expanded at an annual pace of 10.1%.

- India also provides a very compelling case for copper demand, especially with respect to its power needs. According to the International Energy Agency, India's power production needs to rise by 15% to 20% annually and to meet that, India needs to invest USD1.25 trillion by 2030 into energy infrastructure. From this new infrastructure, India's annual copper demand is expected to more than double.



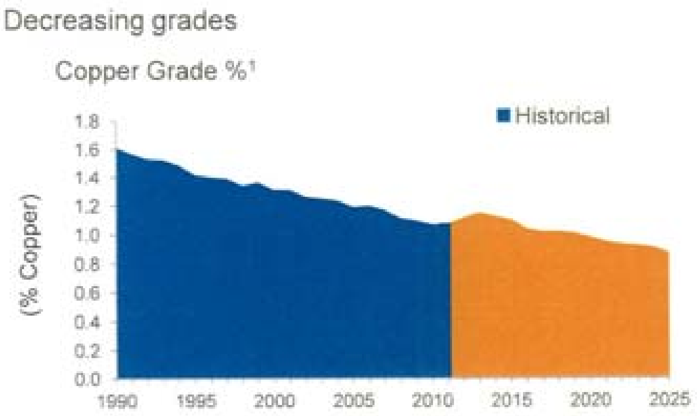
srk consulting	**Metorex** Per capita refined Cu consumption (left) and World urbanisation prospects % 1950 to 2050 (right) (source: Rio Tinto, after UN)	Project No. 453459

Figure 2.2: Per capita refined Cu consumption (left) and World urbanisation prospects % 1950 to 2050 (right)

Chinese demand is not the only major factor to consider in the outlook for copper. The world is also beginning to feel the impact of supply challenges. The industry is experiencing difficulties with respect to the production of copper from various aspects of the production cycle:

- Discoveries of higher grade deposits are becoming less frequent;
- More underground mines are producing copper, at a smaller output capacity than open pits;
- An increasing proportion of new supply is located in riskier countries;
- More challenging environments due to lack of infrastructure imply an increase in the capital intensity of new projects;
- Declining average grades (see Figure 2.3);
- Supply disruptions will continue due to:
  - Technical complexity;
  - Project delays;
  - Labour strike action.

Market commentators suggest that current production numbers are indicating that supply side issues may be starting to show. It is argued that metal prices are holding up as there have been only marginal increases in new copper mine development over the past five years, despite continued growth in demand.



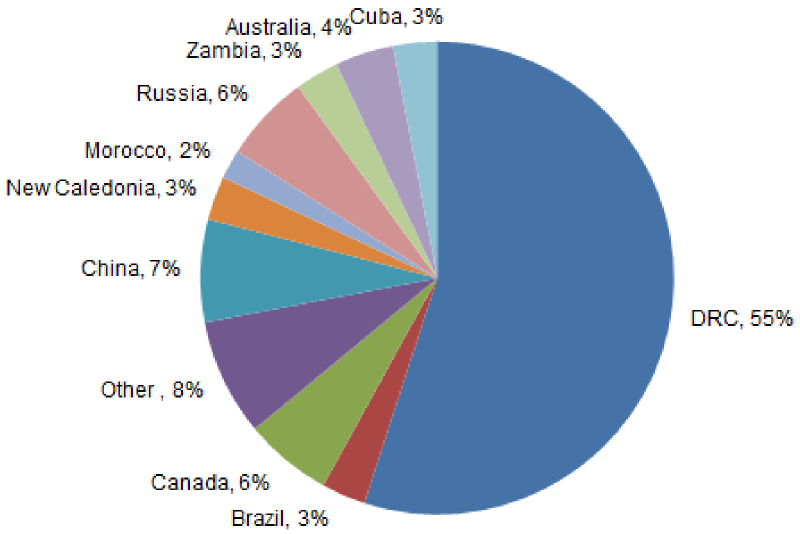
srk consulting	**Metorex** Decreasing copper grades (source: Rio Tinto, after Brook Hunt)	Project No. 453459

Figure 2.3: Decreasing copper grades

2.2.2 Supply and Demand for Cobalt

Cobalt is used primarily in the form of an alloy which is either used as the base metal or as an alloying element. Cobalt is used in the production of Ni-Cad batteries and as an alloy hardening agent for aircraft jet engines, gas turbines and coatings for other metal surfaces as well as diamond tools. In the form of an oxide, cobalt is used in pigmentations for glass and porcelain as well as being used as a supplement in animal feedstock. In organic derivative forms it is used in paints and tyres. Radioactive ^{60}Co is used in the treatment of cancer. Cobalt is essential to many living creatures and is a component of vitamin B_{12}.

World mine cobalt production totalled 110 kt in 2012 according to Mineral Commodity Summaries, USGS. Africa was the dominant regional producer, with the DRC and Zambia accounting for 55% and 3% of world production in 2012 respectively, as set out in Figure 2.4. Both the DRC and Zambia produce mainly cobalt in oxide and sulphide form as derived from copper ores, whereas in Australia cobalt is found in conjunction with nickel oxide ores.



srk consulting	**Metorex** World Cobalt Mine Production in 2012 (source: USGS Mineral Commodity Summaries)	Project No. 453459

Figure 2.4: World Cobalt Mine Production in 2012

World refined cobalt production trends for 2006 to 2010 from the Cobalt Development Institute ("**CDI**") are summarised in Table 2.2. Production figures for 2011 and 2012 in Table 2.2 are based on information reported by Darton Commodities. Production from the Ambatovy project in Madagascar and the Formation project in Idaho, USA, is expected to add 7.1 kt to world production from 2013. Usage trends for cobalt are not readily available from the internet. However, the market was in oversupply in 2011 and 2012, and is expected to persist through to 2016. Demand for cobalt is expected to rise at about 7% year-on-year to over 100 kt by 2016, driven mainly by demand for chemicals for the battery industry and superalloys for aircraft engines. The cobalt market is expected to continue to suffer from oversupply and weak prices at least until 2016.

Table 2.2: World refined cobalt production and usage trends – 2006 to 2012 (CDI, Darton)

Item	Units	2006	2007	2008	2009	2010	2011	2012
World Refined Production	(kt)	53.6	53.7	56.8	59.4	73.9	79.9	76.0
World Consumption	(kt)	n/a	60.4	54.6	53.0	58.6	69.2	73.9

On the production side, though, policy changes, political and regional instability, power supply problems and transportation logistics in the DRC and across Africa could result in supply disruption.

Owing to the use of cobalt in rechargeable batteries that are currently used in the production of hybrid electric vehicles on a large-scale basis, the market for cobalt is poised for growth in years to come.

According to Darton Commodities, significant destocking of both unrefined and refined cobalt materials in China during 2012 should reduce the overall supply and demand imbalance, which had undermined the cobalt market for the past couple of years. This coupled with lower shipments from Africa and the booming smartphone industry should help to limit the downside for cobalt prices.

2.3 Commodity Prices

2.3.1 Copper

Historical copper prices from 1989 to June 2013 and last 12 months are shown in Figure 2.5.

The three-year trailing average price for Cu for July 2010 to June 2013 at the Valuation Date is USD8 171/t (or USD3.71/lb) Cu, as set out in Table 2.3. This is the Cu price that has been used in the forward looking statements for valuation purposes.

Table 2.3: Copper and cobalt prices – H2-2010 to H1-2013 and 3-year trailing average (source: Bloomberg)

Item	Units	Historic Metal Prices				
		Av. H2-2010	Av. 2011	Av. 2012	Av H1-2013	3-year trailing average
Copper	(USD/lb)	3.60	4.00	3.61	3.42	3.71
	(USD/t)	7 940	8 813	7 958	7 543	8 171
Cobalt	(USD/lb)	17.49	16.01	13.12	12.13	14.66
	(USD/t)	38 561	35 297	28 931	26 739	32 328

2.3.2 Cobalt

Historical cobalt prices from 2005 to June 2013 and last 12 months are shown in Figure 2.6.

The three-year trailing average price for Co for July 2010 to June 2013 at the Valuation Date is USD14.66/lb, as set out in Table 2.3. This is the Co price that has been used in the forward-looking statements for valuation purposes.

2.3.3 Sulphuric Acid

Ruashi Mine operates a sulphuric acid plant, which can produce acid at the rate of around 7 750 tpm for use in its solvent extraction-electrowinning ("**SX/EW**") process. This is surplus to the requirements of the SX/EW plant, with the balance available for sale. The sale of acid is governed by the over-supply of acid from Zambia, which forced prices down during 2012 to below USD300/t.

The Ruashi acid plant was operated intermittently during 2012 due to power supply problems. With the installation of additional diesel-generating capacity at Ruashi Mine in 2013, Ruashi Mine has been able to operate the acid plant on a more continuous basis.

A by-product of the acid plant is SO_2 gas, which is used to control the leaching environment for cobalt. Once the acid plant can be run on a more continuous basis, a consistent supply of SO_2 gas can be achieved, thereby replacing the more expensive sodium meta bisulphite used to generate the SO_2 gas.

srk consulting	**Metorex** Historical copper prices from 1989 to June 2013 (left) and last 12 months (right) (source: InfoMine.com)	Project No. 453459

Figure 2.5: Historical copper prices from 1989 to June 2013 (left) and last 12 months (right)

srk consulting	**Metorex** Historical cobalt prices 2005 to June 2013 (left) and last 12 months (right) (source: InfoMine.com)	Project No. 453459

Figure 2.6: Historical cobalt prices 2005 to June 2013 (left) and last 12 months (right)

2.4 SRK Comments

The commodity market was extremely volatile in 2008/2009, due to the global collapse in the commodities market and the world economy. Commodity prices were driven higher by speculative dealings and market hype during 2007 and early 2008, collapsing dramatically in late 2008 and 2009. For example, the JSE All Share index decreased from around 37 000 in July 2008 to around 18 000 in mid-2009.

Use of a 3-year trailing average price is frequently done in mineral asset valuation and is a method accepted by the Securities Exchange Commission of the United States of America and the Securities Commissions of Canada. This method relies on the precept of *history being the best predictor of the future* and is based on actual results, rather than commodity price forecasts which rely on projections from historical trends and analysts' interpretations of future supply/demand positions.

SRK is satisfied that the 3-year trailing average price is acceptable for purposes of this CPVR.

A OPERATING MINES

3 RUASHI MINE

3.1 Introduction

[SR1.5A(i)]

Ruashi Holdings is a South African registered wholly owned subsidiary of Metorex, and has a 75% interest in Ruashi Mining, a private limited liability company registered in the DRC. The remaining 25% of Ruashi Mining is held by Gécamines, a state owned mining company registered in the DRC.

Ruashi Mine is an open cast mining operation, located near Lubumbashi in the Katanga province of the DRC, at which copper cathode and cobalt hydroxide is produced, and sold under off-take contracts.

3.2 Location, Climate, Access and Infrastructure

[SR1.4A, SR1.5A(i), SR1.6, SV2.3]

The Ruashi Mine is located in the DRC at latitude 11°37'S and longitude 27°33'E, 10 km east of Lubumbashi, the capital city of Katanga Province. The mine is located in the peri-urban area to the northeast of Lubumbashi and on the outskirts of Ruashi Commune, consisting of the Kalukuluku, Luano and Kawama village (Figure 3.1).

The mine is located approximately 3.5 km southeast of the Lubumbashi International airport, and is accessed using either an 11 km gravel road, off the Luano International Airport road, or an unpaved commune road. Both roads connect to the Lubumbashi central business district via 5 km of tarred roads in a relatively good condition.

The Congolese Copper belt is located in a sub-tropical zone characterised by distinct wet and dry seasons. Annual rainfall is approximately 1 200 mm and occurs during a wet season (summer) lasting from October to March with the heaviest rainfall occurring between December and March.

Rainfall generally occurs as short thunderstorms any time during the day or night, and it is not uncommon to have 50 mm of rain in the space of a few hours. Mining production is frequently impacted by the high rainfall as production from the open pits is stopped to allow haul ramps to dry. Key RoM stockpiles and primary crushing installations are also impacted if material is too wet. Exploration drilling activities on the prospects are generally restricted to the dry season as vehicle access off the main bush tracks is not feasible during the wet season.

The average air temperature remains fairly constant at between 17°C and 24°C throughout the year and there is no distinct winter and summer temperature regime. Average temperatures peak during September and October at 32°C. The coldest month is July with an average daily minimum of 6°C.

The Ruashi Mine is located to the north of a northwest to southeast trending topographic high that acts as a local water divide. Topographic elevations range between 1 320 m above mean sea level ("**amsl**") at the water divide to 1 235 m amsl at the topographical low in the east. In the vicinity of the mine site, the elevation is approximately 1 285 m amsl.

The main arterial road from Lubumbashi to Kasumbalesa has been further upgraded by Chinese contractors during 2010. Border control at Kasumbalesa between the DRC and Zambia has improved as a result of infrastructure upgrade.

Water to the mine is supplied from underground aquifers. The geology is largely dolomitic and significant quantities of subsurface water are available. Return water from the tailings dam is also used in the plant.

Power in the DRC is regulated and supplied by Société Nationale de Electricité ("**SNEL**"), the national power utility. The Ruashi Mine is fed at 220 kV (40 MW) by a dedicated power line. Furthermore, as part of the Phase II capital programme, Ruashi Mining spent some USD11 million in upgrading SNEL's main supply sub-station in Lubumbashi. The mine has rented 13 diesel generators from Agrekko, capable of producing 13 MW, since February 2013 and has purchased a further 7 Caterpillar diesel generators, capable of producing 15 MW, which will be operational by August 2013. Metorex has decided to purchase the Agrekko generators during H2-F2013, which means that the Ruashi Mine will effectively be self-sufficient in power supply.

3.3 Mining History

3.3.1 Historical Development of Ruashi Mine

[SR1.3, SR1.4, SR1.5A(ii), SV2.4]

To date, mining activities at the Ruashi Mine have been carried out in two phases. The Ruashi Phase I concentrator plant ("**Phase I**") consisted of an oxide concentrator plant to treat the oxide ore stockpiles left by Union Miniére du Haut Katanga ("**UMHK**") and Gécamines.

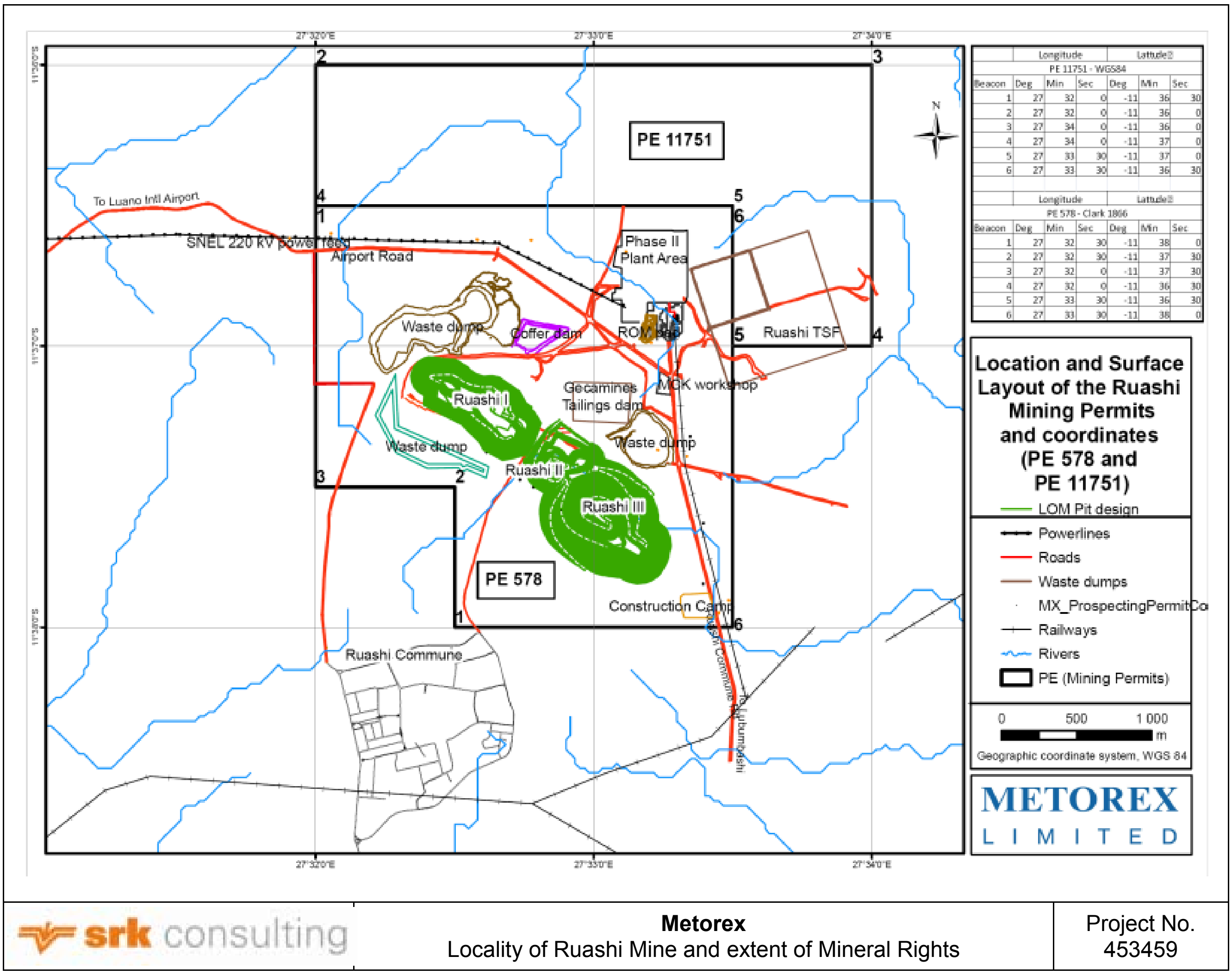


Figure 3.1: Locality of Ruashi Mine and extent of Mineral Rights

The Ruashi Phase II hydrometallurgical plant ("**Phase II**") came on stream in early 2008, comprising leaching-decantation, solvent extraction/electro-winning ("**SX-EW**") and cobalt precipitation operations.

The historical development of the Ruashi Mine is summarised in Table 3.1.

Table 3.1: Ruashi Mine – Historical Development

Date	Activity	Comments
1907	Earliest recorded exploration work by Tanganyika Concessions Limited	
1911	UMHK discovers Etoile orebody	
1919	UMHK discovers the Ruashi ore bodies	Three ore bodies, called Ruashi I, Ruashi II and Ruashi III.
1911 – 1926; 1935 – 1946; 1953 - 1964	Intermittent mining conducted at Etoile orebody	High grade Cu oxides (>5% Cu) were selectively mined and processed as direct feed in the UMHK Lubumbashi smelter (now defunct). Lower grade material was stockpiled.
1919, 1931, 1932 – 1935; 1960 - 1963	Intermittent mining conducted at Ruashi ore bodies. Limited underground mining carried out –limited to prospect drives and crosscuts for sampling purposes.	
1967	UMHK mines including Ruashi and Etoile nationalised; Gécamines established as the state mining company.	
1980s	Gécamines completes geological reserve estimate using a manual polygonal estimation method.	Not SAMREC compliant.
1980s to 1990s	Gécamines experiencing production problems due to lack of reinvestment into operations.	Cu production had declined from 450 ktpa to 30 ktpa, Co production from 10 ktpa to 4 ktpa.
1996	Commenced with the privatisation of the exploitation rights to the Ruashi Cu-Co ore body.	
1997	JCI Projects Ltd ("JCI") embarked on systematic exploration programme of Ruashi and Etoile stockpiles	Scoping study completed.
2000	Cobalt Metals Company Ltd ("**CMC**") acquired the rights to and entered into an agreement with Gécamines for the exploitation of the Ruashi orebody and the Ruashi and Etoile stockpiles.	Concession No 237 was transferred to CMC.
2001	Scoping study of Ruashi resources and reserves compiled for CMC. Pre-feasibility study resource model compiled by Digital Mining Services ("DMS").	Reviewed in 2004, but not accepted by SRK.
June 2003	Ruashi Mining was created and registered in the DRC in 2003, with CMC holding a 55% interest and Gécamines a 45% interest.	Concession 237 transformed into two separate exploitation licences or permis d'exploitation ("PE"); PE578 granted exploitation rights to Ruashi Mining.
2003	Metorex conducts pre-feasibility study and sampling of the Ruashi stockpiles.	
May 2004	Metorex acquires Sentinelle's 65% interest in Ruashi Holdings in exchange for USD2.5m payment, completion of a feasibility study, supply of 2nd-hand plant to Ruashi and raise development capital.	
2004	CMC's rights and obligations transferred to Ruashi Holdings. Ruashi Mining held by Ruashi Holdings (80%) and Gécamines (20%).	
May 2004	Metorex entered into an agreement with Sentinelle Global Investments group in exchange for a 65% interest in Ruashi Holdings.	
2005	Mineral resources in stockpile signed off by SRK; Metorex increases interest in Ruashi Holdings to 84%.	Ruashi: 1.5 Mt @ 1.84% Cu and 0.34%Co Etoile:1.7 Mt @ 1.88% Cu and 0.35% Co.
2005/6	Metorex conducted verification drilling programme of 6 665 m to address concerns raised by SRK.	
May 2005	Commenced construction of Phase I concentrator plant.	
September 2006	First concentrate produced.	Low grade concentrate sent to the Sable plant in Zambia. Cu cathode and Co carbonate produced in SX-EW plant.
March 2007	Construction of the Phase II hydrometallurgical plant commenced. Metorex holds 100% interest in Ruashi Holdings	Plant was built and commissioned in phases.
October 2007	Open pit mining commenced at Ruashi I ore body	
March 2008	Early copper first produced	Direct EW Cu, no SX.
October 2008	Copper circuit incorporating the SX plant commissioned.	
February 2009	Cobalt plant commissioned.	
March 2009	Phase I concentrator plant placed on care and maintenance	
2009	Metorex completes two drilling campaigns across all three ore bodies. Ruashi Holdings interest in Ruashi Mining decreased to 75%.	1 651 m (48 holes) of reverse circulation ("RC") drilling; 5 229 m (52 holes) of diamond drilling.
2010	Ruashi Mining completed three drilling programmes – 51 holes (965 m) or percussion drilling across the BOMZ in Pit 3, 78 holes (5 524 m) of in-fill drilling in Pit 1, 36 holes (7 160 m) to explore ore body extensions to east and north of Pit 3.	

3.3.2 Historical Operating Statistics

Brief historical operating statistics for Ruashi Mine are summarised in Table 3.2.

Table 3.2: Ruashi Mine – Historical Operating Statistics

Item	Units	2009/10 (1)	F2011	F2012	H1-F2013
Production					
RoM ore mined	(kt)	2 038.1	1 456.9	1 273.7	811.0
Waste mined	(bcm)	6 343.0	7 557.1	5 281.1	1 495.9
Strip Ratio	(bcm/t)	6.20	5.19	4.15	1.84
Plant feed	(kt)	1 838.0	1 259.3	961.7	546.9
Head grade - Cu	(%)	2.90%	3.25%	3.22%	3.31%
Head grade - Co	(%)	0.51%	0.43%	0.46%	0.41%
Plant recovery - Cu	(%)	80.1%	84.3%	85.0%	88.8%
Plant recovery - Co	(%)	55.0%	68.5%	69.5%	67.7%
Recovered Cu	(kt)	43.0	34.5	27.0	16.1
Recovered Co metal in hydroxide	(kt)	5.1	3.7	3.0	1.5
Sales					
Sales - LME grade Cu	(kt)	43.0	34.6	26.8	16.1
Sales - Co	(kt)	5.1	4.0	3.2	1.4
Av. Price received - Cu	(USD/t)	7 067	8 513	7 731	7 497
Av. Price received - Co	(USD/t)	26 371	24 142	16 484	17 828
Operating Costs					
On-mine costs	(USD m)	194.2	148.3	164.6	99.3
Salaries & wages	(USD m)	20.0	26.7	31.4	18.3
Mining Costs	(USD m)	40.8	17.8	18.9	14.8
Processing Costs	(USD m)	88.6	70.2	68.5	43.7
Engineering costs	(USD m)	17.8	10.8	12.5	5.3
SHEC	(USD m)	-	5.5	0.9	1.6
Administration costs	(USD m)	27.9	17.3	32.3	11.4
Stock movement	(USDm)	(0.9)	-	-	4.2
Off mine costs	(USDm)	54.1	49.8	39.2	16.3
Transport costs	(USD m)	32.2	31.2	20.2	9.6
Clearing costs	(USD m)	21.9	18.6	19.0	6.7
Royalties	(USD m)	18.9	17.8	14.3	6.2
Unit Costs					
On-mine cost	(USD/t milled)	100.00	117.75	171.19	181.61
Operating cost per t Cu produced	(USD/t Cu produced)	4 539	4 294	6 103	5 914
Operating Cost per t of Cu, net of Co credits	(USD/t Cu produced)	2 627	2 356	4 146	4 929

(1) Represents 18 months from July 2009 to December 2010.

3.4 Title and Rights

3.4.1 Mineral Rights

[18.05(3), SR1.7A, SR5.1A, SV2.3]

On 11 December 2009, an agreement was entered into with Chemaf sprl for the acquisition of a portion of PE1538 to the north of, and contiguous with PE578. This portion was converted to a new mining licence (PE 11751) and ownership transferred to Ruashi Mining.

The details of the mining licences granted to Ruashi Mining related to the Ruashi Mine are summarised in Table 3.3 (see also Figure 3.1).

Table 3.3: Ruashi Mining – details of Mining Licences at Ruashi Mine

Licence	Type of Title	Area (ha)	Valid From	Expiry Date	Commodity
PE578	Exploitation Permit	900	26 Sep 2001	25 Sep 2021	Cu, Co, base and precious metals
PE11751	Exploitation Permit	420	11 Dec 2009	10 Dec 2039	Cu, Co, base and precious metals

3.4.2 Surface Rights

By virtue of its mining licence, Ruashi Mining is granted the exclusive right to use the land on which the stockpiles and ore bodies are situated, and to build installations and facilities required for mining exploitation.

3.4.3 Royalties

[SR5.7C(v)]

During 2008, the Government of the DRC, through the Department of Mines, instructed the state owned mining companies to renegotiate the terms of their partnership agreements, which included the Partnership agreement and Statutes governing the shareholder relationship between Ruashi Holdings and Gécamines. The outcome of these negotiations was that Ruashi Holdings conceded a 5% interest in Ruashi Mining, resulting in its interests reducing to 75% and Gécamines increasing from 20% to a 25% carried interest.

Ruashi is obligated to pay to Gécamines a royalty on gross revenue derived by the mine less Cu transport costs, calculated at 2.5% and furthermore, is obliged to pay the state royalty of 2.0% on mine revenue (sales less transport and clearing costs). In addition to the royalty payment, Ruashi Mining was also obligated to make payment of a deferred mineral content fee payment of USD4 million to Gécamines. By December 2012, Ruashi had paid the full amount to Gécamines.

3.5 Geology

[SR1.2, SR1.3, SR2.5A/B/C, SR4.1A(i), SV2.5]

3.5.1 History of the Project Area

The Etoile and Ruashi ore bodies were discovered by UMHK in 1911 and 1919, respectively, and were both intermittently mined as high grade **("HG")** copper oxide quarries over a period spanning half a century. UMHK mined the very HG oxide cap at the Ruashi Mine in the early part of the last century. At that stage, the deposit ran at an average grade of 7% Cu and higher. This ore was mined as Direct Shipping Ore **("DSO")** or processed through a washing plant, before being processed in the open hearth blister furnaces that were operated in Lubumbashi at the time.

The UMHK mines, including Ruashi and Etoile, were nationalised in 1967 and Gécamines was established as the state mining company to control all copper and cobalt production and exploration across the Katanga Province.

The earliest recorded exploration work commenced in 1907 by Tanganyika Concessions Ltd who excavated pits and dug trenches in the area. The Ruashi area has been extensively investigated by pitting, trenching, geophysical methods as well as diamond and reverse circulation drilling over the last century. Since discovery in 1919 and up to December 2012, 1 434 drill holes have been completed on the Ruashi property giving a total of 110 952 m.

The Ruashi ore body was evaluated by UMHK and Gécamines over a period of nearly five decades, with drilling carried out on sections spaced at 50 m intervals, along strike and intervals, and along sections of between 12 m and 50 m. Historical drilling activities at Ruashi prior to privatisation amounted to 1 047 holes over a total of 76 548 m.

In 1997, JCI Projects Ltd ("**JCI**") embarked on a systematic exploration programme to validate the existing Gécamines mineral resource information for selected Ruashi and Etoile stockpiles. JCI also undertook diamond-drilling and detailed structural and geological mapping of the ore body, and conducted detailed mineralogical and metallurgical studies on stockpile material.

Metorex completed a dump drilling campaign on the Ruashi stockpiles as part of the 2003 Phase I feasibility study, to verify the grades and mineralogy of the stockpile material to be processed through the Phase I concentrator plant. These stockpiles have largely been depleted and the mineral resources remaining to be mined at Ruashi are largely in-situ within the three separate ore bodies, commonly referred to by the Ruashi Mine as Ruashi I, Ruashi II and the Ruashi III ore bodies.

Metorex carried out a verification drilling program during 2005/6 of 6 665 m of drilling to address certain of the concerns raised by SRK in their Independent CPR dated March 2005.

A number of historical mineral resource estimates have been completed for the Ruashi ore bodies, the last performed by Integrated Geological Solutions (Pty) Ltd ("**IGS**") in July 2012.

3.5.2 Regional Geology

The Ruashi ore body is a stratiform, sediment-hosted copper deposit ("**SSC**") located in the Central African Copper belt. The Copper belt forms one of the world's greatest metallogenic provinces containing over a third of the world's cobalt reserves and a tenth of the world's copper reserves. The Central African Copper belt is second only to the Chilean Porphyry belt in terms of copper endowment but lags significantly in terms of production.

The copper-cobalt deposits of the Central African Copper belt are hosted within a strongly deformed, arcuate belt of rocks that extends from north-eastern Angola through southern DRC and into Zambia, referred to as the Lufilian Arc as illustrated in Figure 3.2. The major ore bodies of both Zambia and the DRC are associated with the most strongly deformed zones along the northwest-southeast axis of the arc and occur along distinctly linear trends.

The different nomenclature for the basal Roan Supergroup reflects not only the different geological history of the belt but also a lack of correlation across national boundaries. Consequently, two sub-types of SSC deposits are distinguished in the rocks of the Central African Copper belt. These are divided on geographical lines into a northwest district in the DRC ("**Congolese Copper belt**") and a southeast district in Zambia ("**Zambian Copper belt**") (Figure 3.3).

The Katangan Sequence is divided into three Supergroups separated by two marker conglomerates (possibly glacial tillites). These units are described briefly below (from youngest to oldest) and are illustrated in the general stratigraphy of the Katanga System in Figure 3.4.

- The Upper Kundelungu Supergroup (**Ks**): formed by detrital marine sediments, predominantly dolomitic; divided into three groups (Ks 3, Ks 2, Ks l) based on sedimentary cycles. Minor sandstone units are scattered throughout the succession;
- The Lower Kundelungu Supergroup (**Ki**): formed by detrital marine sediments, predominantly dolomitic but with limestones and dolostone in the south (the Kakontwe Limestone); divided into two groups (Ki 2 and Ki 1), based on sedimentary cycles; up to 3 000 m thick; and
- The Roan Supergroup (**R**): lagoonal and fluvial marine sediments — dolostone, dolomitic siltstones and black shales with interstratified collapse breccias formed by the dissolution of evaporitic horizons; arkosic sandstones and conglomerate units; total thickness 1 500 m.

In the DRC, the Roan Supergroup is divided into the *Roches Argileuses Talceuse* ("**RAT**"), Mines, Dipeta and Mwachya Groups. The Mines Group is frequently referred to as the Series des Mines.

The metasedimentary successions in the DRC are strongly thrusted and folded into a series of broken anticlines and synclines that are commonly overturned towards the north. Despite the obvious disruption of the sequence, the pre-Katangan basement is not exposed anywhere along the belt in the DRC.

The stratiform ores in the DRC occur within two principal formations confined to a 40 m thick succession at the base of the Mines Series. The upper formation comprises sandy shale, containing some carbonates. The lower formation consists of bedded dolomitic sandstone. The ore formations average approximately 10 m in thickness separated by 20 m to 30 m of siliceous dolomite. Ore grades commonly vary between 4% and 6% Cu and around 0.4% Co, with the ratio of Cu to Co in the order of 8:1.

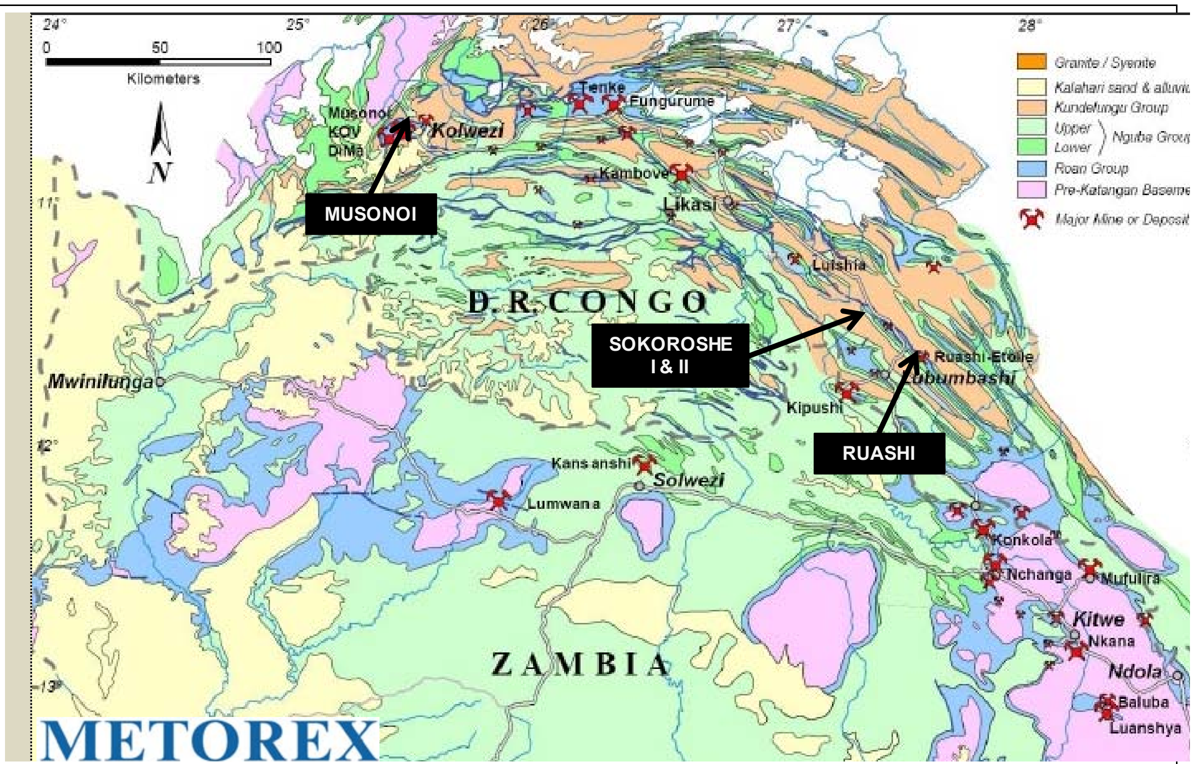
The weathered oxide zone generally extends to a depth of between 70 m and 150 m, but may vary considerably between deposits. The weathering process commonly leads to high-grade supergene deposits near surface, but may also result in leaching of the mineralisation in places and/or concentration in otherwise barren horizons. At depth, a mixed oxide-sulphide zone grades into sulphide ore, sometimes at depths greater than 250 m.

3.5.3 Project Geology

The Ruashi deposits are typical of the Congolese Copper belt deposits and are geologically similar to the Tenke Fungurume and Kamoto deposits. The stratiform Cu-Co deposits represent the largest and most important of the ore types, covering the area from Kasumbalesa in the southeast to Kolwezi in the northwest.

The Ruashi copper-cobalt ore bodies are situated within a 24 km long by 2 km wide, northwest to southeast trending fold structure. The Lukuni-Ruashi-Etoile trend consists of a recumbent, synclinal fold, Ruashi on the southern limb and Etoille on the northern limb. The flanks are made up of Roan rocks and the core by the Mines Group, all occurring to the southwest of a prominent regional northwest to southeast trending thrust fault. A local thrust fault dipping to the south, locates within the RAT formation immediately south of the Ruashi ore bodies. A listric fault-breccia pattern separates the ore bodies from one another.

Three ore bodies have been identified at the Ruashi Mine, namely Ruashi I, Ruashi II and Ruashi III. The distribution of these ore bodies is shown in Figure 3.5.



srk consulting	**Metorex** Regional Geology of the Central African Copper Belt	Project No. 453459

Figure 3.2: Regional Geology of the Central Africa Copper Belt

<table>
<tr><td rowspan="6">KATANGAN</td><td colspan="4">Lithostratigraphic Correlation of the Zambian and Congolese Copperbelts</td></tr>
<tr><td colspan="2">D.R.C</td><td colspan="2">ZAMBIA</td></tr>
<tr><td rowspan="4">ROAN SUPERGROUP</td><td>Mwashya Group</td><td colspan="2">Mwashia Group</td></tr>
<tr><td>Dipeta Group</td><td>Carbonate Unit</td><td>Upper Roan</td></tr>
<tr><td>Mines Group (Series des Mines)</td><td>Mixed Unit</td><td rowspan="2">Lower Roan</td></tr>
<tr><td>R.A.T</td><td>Siliciclastic Unit</td></tr>
<tr><td colspan="5">BASEMENT</td></tr>
</table>

srk consulting	**Metorex** Simplified lithostratigraphic correlation of the Katangan Supergroup of the Zambian and Congolese Copper belts	Project No. 453459

Figure 3.3: Simplified lithostratigraphic correlation of the Katangan Supergroup of the Zambian and Congolese Copper belts

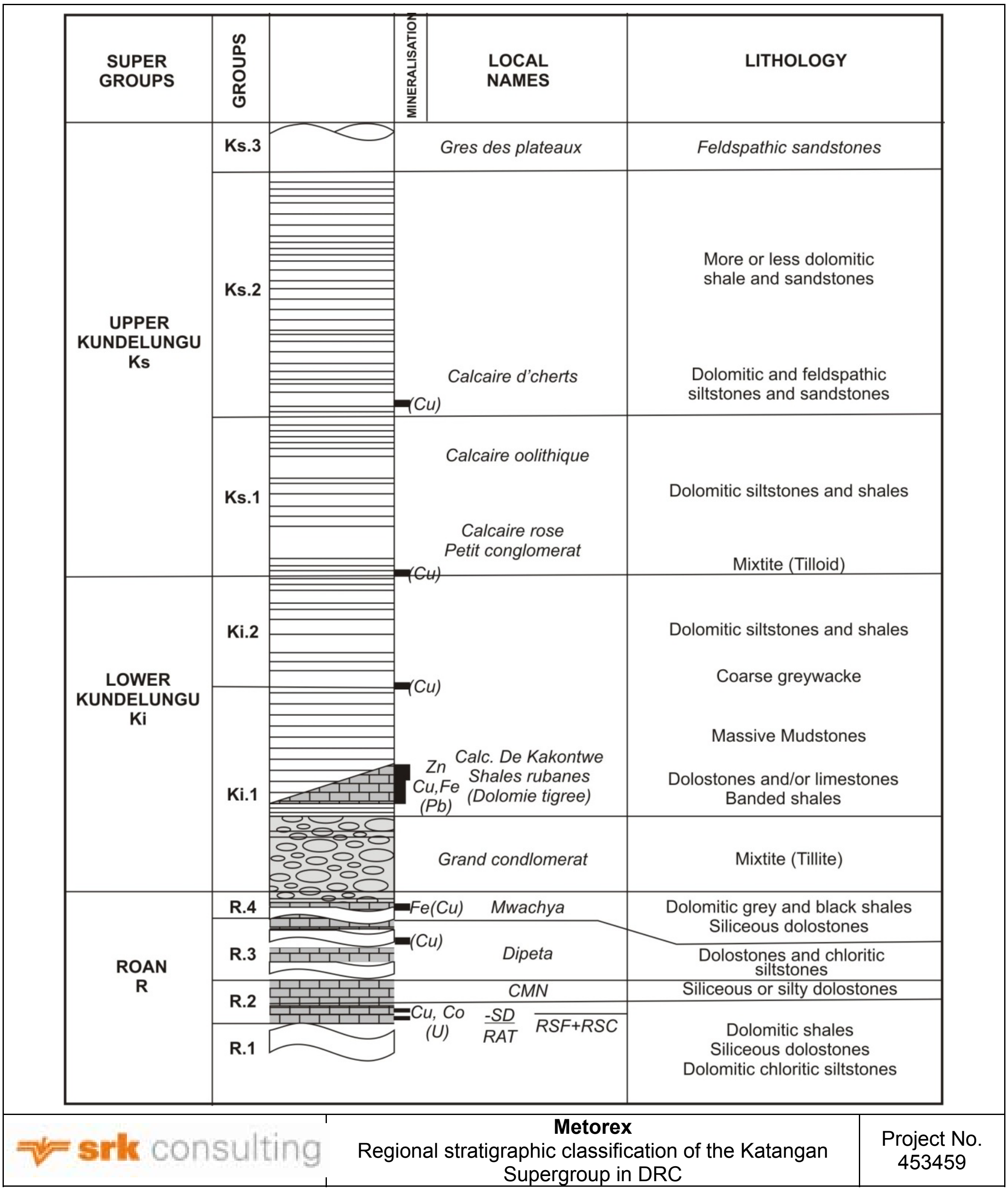


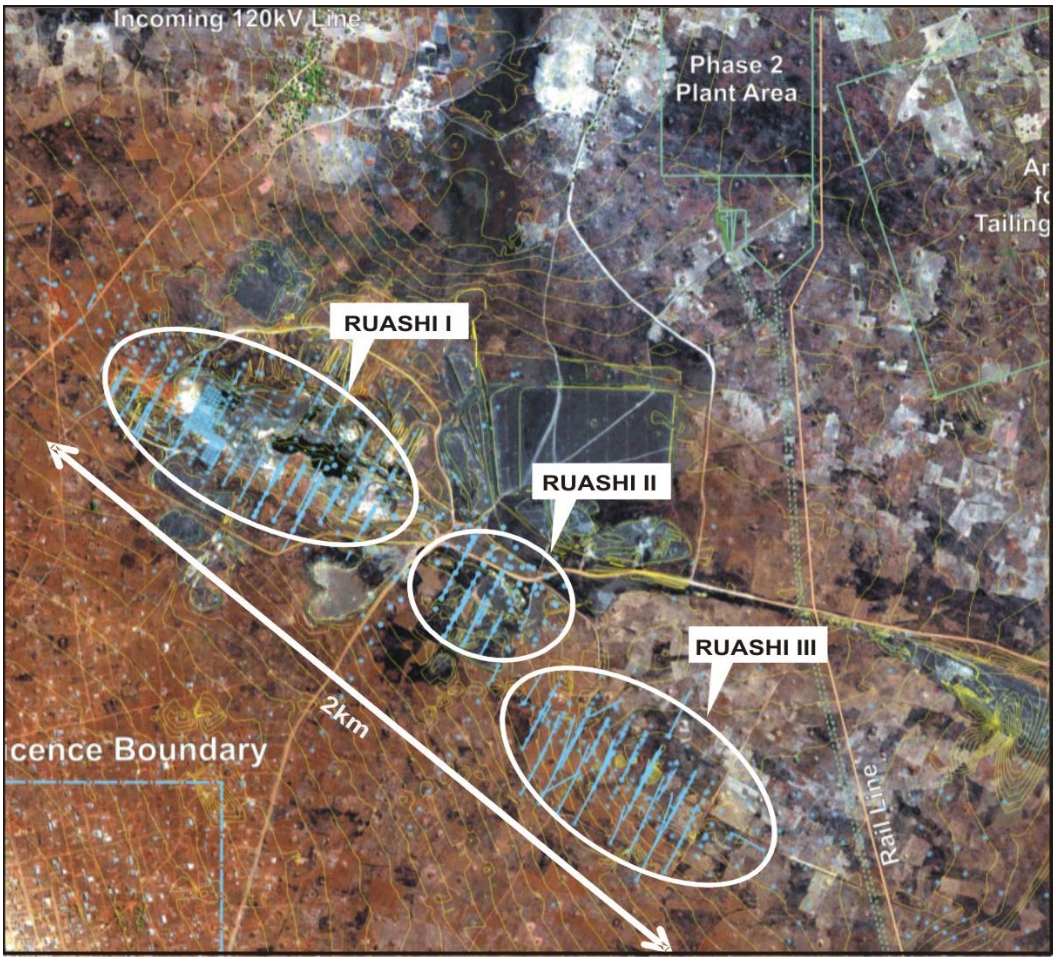
Figure 3.4: Regional stratigraphic classification of the Katangan Supergroup in DRC

Ruashi I, the largest of the three, is located in the northwest of the mining area. The lateral extent of Ruashi I measures approximately 900 m in a northwest to southeast direction and 350 m across strike. In cross-section, the oxide zone extends to approximately 130 m below surface, whilst sulphide mineralisation has been intersected to depths of more than 300 m below surface. The Ruashi I ore body terminates against a brecciated shear zone on the north-western and south-eastern edges of the pit. Some open pit and underground mining was carried out on the Ruashi I orebody in the 1920s and 1930s.

Ruashi II is a smaller fragment, extending along strike for approximately 200 m and 250 m across strike. It terminates against listric shear zones to the north-west and south-east. Currently, a flat lying thrust fault terminates the ore body in depth. Exploration is planned to confirm the lack of, or existence of a mineralised ore body below the thrust fault. A large gap of approximately 200 m of brecciated Lower Kundelungu strata separates Ruashi II from Ruashi I. Previous mining activity on a limited scale was evident at Ruashi II, but mining has now passed through this.

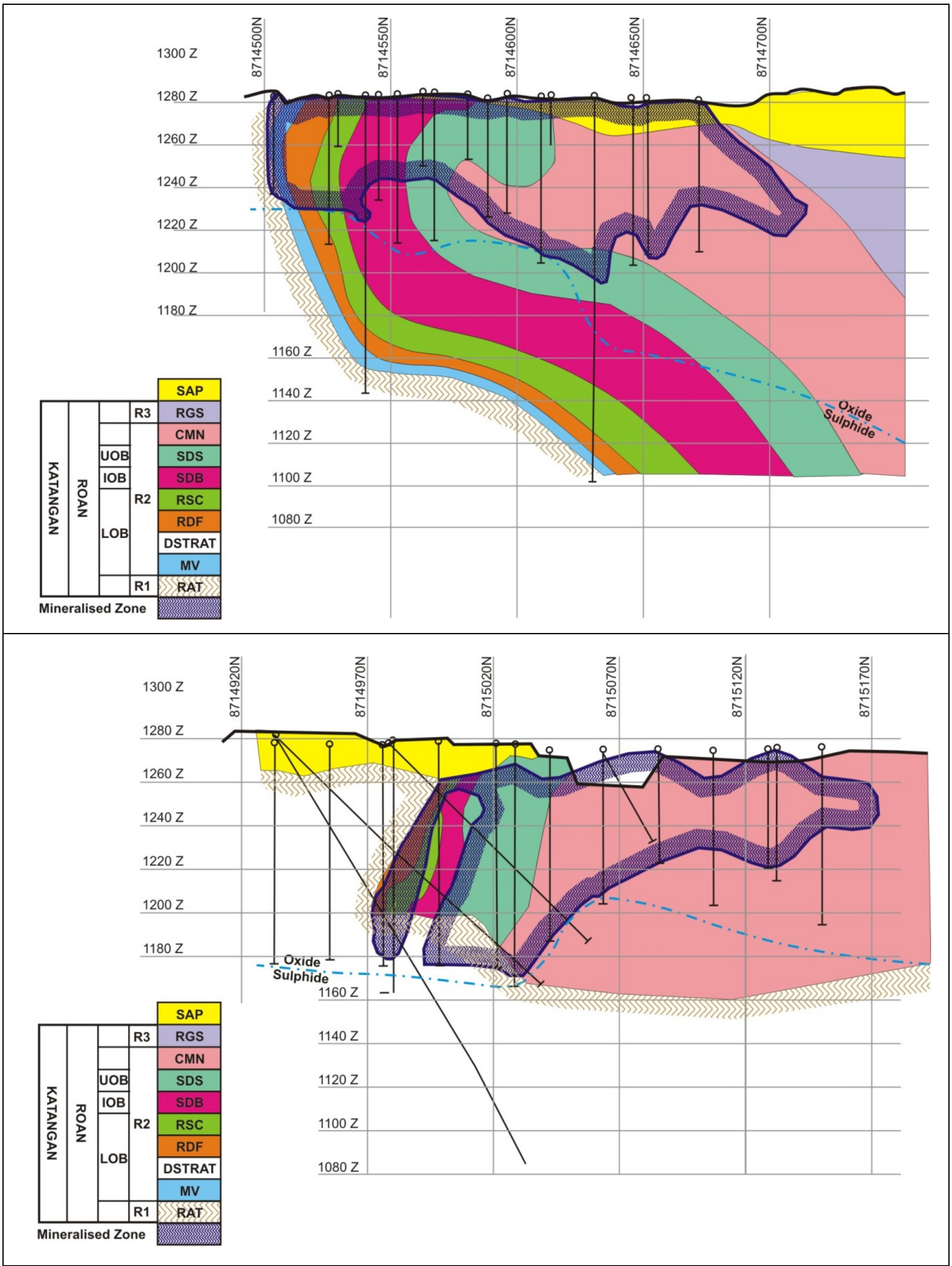
Ruashi III occurs at the south-easterly end and has a strike length of approximately 650 m and a cross strike width of 200 m. Unlike Ruashi I and II, the copper orebody is buried by 30 m to 80 m of cover rocks. A HG cobalt zone or "cap" with low grade copper starts at a depth of approximately 12 m below surface in the west. Ruashi III is structurally controlled within a complex fold structure. The oxide zone extends to a depth of 300 m in the east. Drilling during the latter part of 2010 exposed malachite mineralization some 200 m beyond the previous eastern limits of the ore-body, down to depths of 300 m. Artisanal mining on Ruashi III has not been as extensive as at Ruashi I and II, and was restricted to the upper near surface cobalt zone 10 to 20 m below surface.

Historically, mining by UMHK focussed on near surface oxide copper in the form of malachite and chrysocolla mineralisation. The HG oxides formed a 30 m to 60 m supergene mineralisation blanket in the saprolitic rock close to surface, overlying the primary sulphide ore bodies. This irregular blanket of mineralisation extended beyond the limits of the underlying primary sulphide ores, as portrayed schematically in Figures 3.6 and 3.7.



srk consulting	**Metorex** Location of the Ruashi I, II and III ore bodies within the Ruashi Mine area (blue dots represent drill hole collars)	Project No. 453459

Figure 3.5: Location of the Ruashi I, II and III ore bodies within the Ruashi Mine area (blue dots represent drill hole collars)



srk consulting	**Metorex** Typical sections showing mineralised envelope – section 200 from Ruashi I (top) and section 1100 from Ruashi II (bottom)	Project No. 453459

Figure 3.6: Typical sections showing mineralised envelope – section 200 from Ruashi I (top) and section 1100 from Ruashi II (bottom)

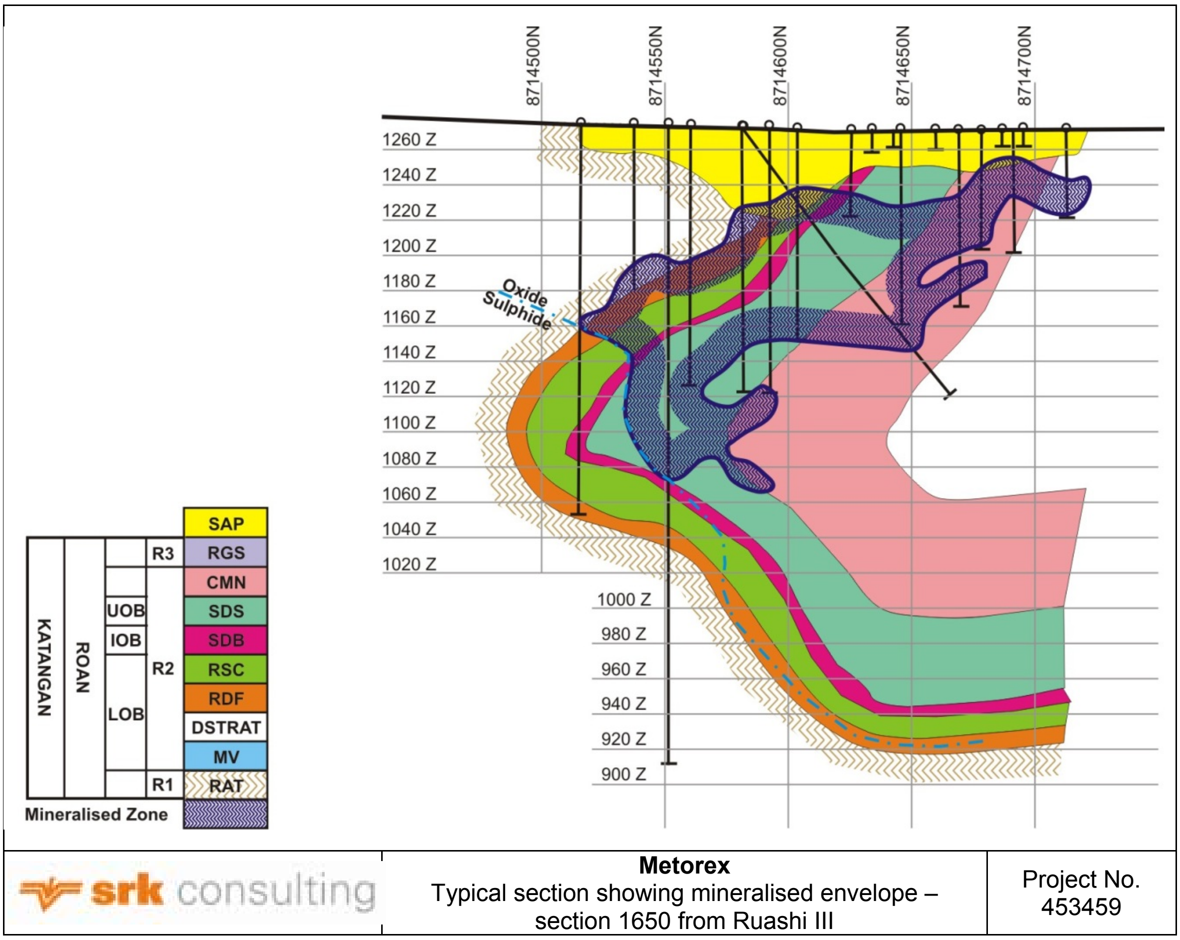


Figure 3.7: Typical section showing mineralised envelope – section 1650 from Ruashi III

Oxide copper minerals at Ruashi include malachite (see Figure 3.8), chrysocolla, native copper, cuprite, cornetite and azurite. Other oxide minerals include magnetite and specularite. The dominant cobalt mineral in the oxide zone is heterogenite. Trace quantities of oxidised uranium minerals have been observed but are very uncommon.

Chalcopyrite and diginite dominate the copper minerals in the sulphide zone (up to 96%). Bornite is found in minor quantities. Cobalt sulphides in the form of linnaeite and carrollite are irregularly distributed in intimate mixtures with the copper sulphides, with sporadic abnormal concentrations. Extremely high quantities of cobalt may occur in veins dominated by cobalto-calcite. Disseminated pyrite is found in all the formations and occurs as small amorphous masses in the grey RAT.

Abundant pyrite mineralization occurs in the graphitic shales of the SDS zone. Chalcocite together with malachite occurs below the water table in the transition zone as replacement rims on primary bornite and chalcopyrite sulphides. Cobalt sulphides generally decrease with depth beyond the transition zone.

srk consulting	**Metorex** Selected hand specimens of malachite from the Ruashi open pit (photos courtesy of Metorex)	Project No. 453459

Figure 3.8: Selected hand specimens of malachite from the Ruashi open pit

3.6 Mineral Resources and Mineral Reserves

[18.8, 18.19, 18.29(1)(c),SR1.1A(iii), SR2.5A/B/C, SR7B, SR8B(i), SV2.6]

3.6.1 Data Quality and Quantity

[SR3.1, SR4.1]

The Ruashi Mine drill hole database contains a total of 1 434 drill holes collected over a period spanning almost 100 years.

Initial drilling of about 700 holes is understood to have been carried out by UMHK between 1920 and 1950 and comprised reverse circulation and diamond drilling. Subsequent drilling was undertaken by Gécamines in the 1970s and 1980s. The initial mining phase was based on this information.

Selected core intersections from the UMHK and Gécamines drilling were stored in the Gécamines Geological Department core yard in Likasi.

Through an exercise of verification/infill drilling programmes carried out by Ruashi Mining in 2001, assurances were made on the quality of the historical drilling information for use in the Mineral Resources modelling and estimation.

In 1997, JCI embarked on a systematic exploration programme to validate the existing Gécamines resource information of selected Ruashi and Etoile stockpiles. JCI also undertook diamond-drilling and detailed structural and geological mapping of the deposits, and conducted detailed mineralogical and metallurgical studies on stockpile material.

While the Quality Assurance/Quality Control ("**QA/QC**") for this programme was detailed, Metorex were never able to validate the drill hole data from the JCI programme and this data has not been added to the Ruashi drill hole database. Consequently, this dataset will not be commented on in further sections of the CPVR.

Metorex sub-contracted an independent geological consultant in December 2004 to undertake a verification exercise on selected cores from these drill holes. The primary objectives of the exercise were twofold: verify the sample grade values and also provide cobalt values for the core lengths reported in the logs with either a <1% or <2% cobalt assay.

Metorex carried out a verification drilling program during 2005/6 to verify and infill the existing Gécamines' drilling where possible and to provide core for assays, lithological identification, QA/QC and density determinations for the Phase II feasibility study. The QA/QC aspects of this study were independently reviewed and signed off by Golder Associates Africa (Pty) Ltd ("**Golder**") in a report dated June 2006.

Ruashi Mining undertook a 6 665 m verification drilling program during 2005/6 across the three ore bodies, of which 5 088 m (69 holes) were by RC and 1 577 m (15 holes) by diamond drilling. The exercise was documented by Golder in their June 2006 audit report.

Ruashi Mining completed two infill drilling campaigns during 2009 to test the continuity of mineralisation across structural and geological domains and to improve confidence in the geological resource model.

During this period, Ruashi Mining also carried out a drill hole geological log validation exercise to improve the level of confidence in the geological lithological coding of historical drill holes in the database. The drilling programme, data collection and recoding exercise was independently reviewed and signed off by Coffey Mining (SA) Pty Ltd ("**Coffey Mining**") in June 2009.

From June 2009 to December 2010, Ruashi Mining continued with an in-fill drilling program in Ruashi I to convert oxide ore from the Inferred to Indicated and Measured Mineral Resource categories. Some 90% of this drilling was completed on a grid of 25 x 25 m. Exploration drilling also continued in the Pit 3 area and exposed oxide and sulphide ore beyond the known limits of the ore body to the east and north.

All historical UMHK and Gécamines topocadastral data was referenced to a local mine grid coordinate system. In 2003, a copy of the detailed hand drawn Gécamines 1:5 000 scale topographic plan was obtained as well as a digitised file of the topography from DMS. Both the digital file of the topography and drill hole collars were supplied in the local mine grid co-ordinate system. This data was converted from the local co-ordinate system into the WGS84 Universal Transverse Mercator ('**UTM**") projection by obtaining accurate UTM readings from several surveyed local co-ordinate beacons in the area using a digital global positioning satellite ("**DGPS**") instrument, and applying a transformation formula to the remainder of the data.

Drill hole collars from 2006 to 2012 were surveyed by the mine surveyor using a Garmin DGPS using the WGS84 UTM projection.

Holes drilled in the 2006 campaign were surveyed down-the-hole by the drilling contractor using a multishot down-the-hole surveying instrument. Minimal hole deviation occurred due to the relatively short hole depths and drill hole diameters of HQ and NQ drilling rods. A similar instrument was used in the 2009 campaign, with all holes surveyed at 50 m intervals down the hole and at the end of hole. Since 2010, all drill holes are surveyed at 50 m intervals using a re-flex multishot camera instrument. Surveys are carried out every 50m during drilling operations as the soft clay of the oxide ore causes closure of some drill holes immediately after drilling.

3.6.2 Sampling Method and Approach

[SR3.2, SR3.3]

There were no details on the sampling protocol adopted during the historical drilling.

Metorex re-sampled the existing historical cores and describe the sampling method and approach on the basis of observations on the existing core.

A total of 102 samples from 16 historical holes were collected at sampling intervals mirroring the observations from the historical logs and the core boxes.

Generally, the saprolite "core" was mixed "in-situ" (to negate any possible concentration at the base of the box) and then sampled by means of "spooning" along the full length of the interval. Where larger chips/cobbles were encountered, these were broken by hammer and a representative portion included in the sample. The average sample weight was approximately 1.6 kg. Photographs were taken of all intervals selected for check sampling and made available to Metorex. Some of the un-oxidised core was photographed to give an indication of the condition of the core.

Given that there was no representative core from the early drilling phase and that fresh rock could not be split due to the lack of a core saw and water in the core yard, only 40% of the check sampling exercise requested by Metorex could be completed.

The sampling method adopted during the 2005/6 drilling campaign as described by Metorex was:

- Drilling was carried out using triple tube split core barrels to ensure the core recovery was maximised.
- Drill core from the diamond rigs was placed in pre-fabricated galvanised core trays and logged on site.
- The drilling runs were clearly marked on yellow plastic blocks.
- Core recovery was estimated on site by measuring the length of core. The observed core recovery was however not very good due to rubbly and clayey material in the oxide zone.
- Core was logged on site on standardised log sheets, capturing depth from, depth to, etc.
- Core was logged in English if the geologist was able to speak English, otherwise in French and then translated by a Metorex geologist in the warehouse to English.
- The original log sheets were kept on file, after copies were made. One copy was kept at the warehouse and one copy is collected by the project manager.
- Core was transported to a warehouse in Lubumbashi for marking and splitting.
- At the warehouse the logging was rechecked by a Metorex geologist before the core was marked for splitting and sampling.
- Core was cut in half with a diamond blade on a standard core cutter, using clean water as a lubricant. This process was done by a labourer, supervised by a Metorex geologist.
- Sampling of the core was done under the supervision of a geologist, with the help of one or two labourers.
- A new plastic bag was used for the sample, with an aluminium tag with the sample number inside the bag.
- The sample number was written on the bag as well. The bag was closed with a cable tie that can only be opened by cutting it, thus ensuring no tampering could occur with the sampled core.
- Half the core was sampled and bagged in a maximum of 1 m lengths and limited to lithological boundaries.
- The weight of each sample varied depending on the interval and recovery but was approximately 2.5 kg.
- The balance of the core was stored in labelled core trays.
- This core was relocated from the warehouse to the Ruashi Mine in 2009 and is stored in a new core yard in the Phase II plant area.

During RC drilling the following protocol was followed:

- Each additional rod was flushed by compressed air before adding it to the drill string.
- The hole was flushed after the new rod was added, so contamination with previous samples was minimised.
- All drilling and sampling equipment was cleaned by compressed air before a new hole was started.
- The whole sample (at 1 m intervals) was captured in a big poly-weave plastic bag, weighed, and then split three times with a Jones riffle to produce one eighth as the subsample.
- The subsample was sealed in a new plastic bag with the sample number on an aluminium sample tag inside, the sample number written outside and again weighed.
- It was eventually sent for sample preparation by Genalysis Laboratory Services (Pty) Ltd ("**Genalysis**") in South Africa.
- The coarse reject of the sample material (the 7/8th residue) was labelled, stacked in numerical order and stored in Lubumbashi in a locked warehouse.
- A small amount of the sample residue was washed in a sieve and logged for mineralogy and lithology.
- This data was recorded on a standardised log sheet by a geologist and the washed residue was kept in a plastic chip sample tray.
- If the sample was wet, it was first sundried at the warehouse before it was weighed, split and sent to South Africa.

Samples were dispatched by air freight in batches of approximately 300 kg and sent from Lubumbashi to the Genalysis laboratory in Johannesburg for sample preparation.

Genalysis documents the sample preparation procedures adopted as:

- Split the samples into workable jobs.
- For core samples, the total sample was dried after jaw crushing (-10 mm).
- The sample was mixed, then the whole sample was ground to nominally 90% -75 micron in an appropriately sized puck type ring mill.
- The bowl was cleaned using a barren quartz flush between samples.
- Approximately 200 g was packaged in a paper sample envelope as the laboratory portion; then sent by air freight to Genalysis in Perth for analysis.
- The rest of the pulp was retained in a new plastic bag at the sample preparation facility for a period of 60 days after the results were received.
- For every 25th sample a duplicate sample was randomly selected by Ruashi Mining at the sample preparation facility.
- For every 50th sample a blank sample was also randomly inserted. The blank sample was made up of sterile material from the Kundelungu and CMN material.

The sampling procedures for the drilling campaigns were similar to those used in 2005/6, with the exception that samples were prepared in the Ruashi Analytical Laboratory sample preparation facility before being assayed.

3.6.3 Sample analytical methods

[SR3.3, SR3.4]

The Metorex report indicates that samples from the UMHK / Gécamines drilling campaigns were assumed to have been analysed at the Gécamines laboratory complex in Likasi. The laboratory complex comprises eleven individual laboratories capable of a wide range of analyses. These laboratories, although used extensively, were not accredited and still remain unaccredited.

There are no details on the sample analytical methods in use during the analyses of the samples from the UMHK and Gécamines drilling campaigns.

Assumptions, based on the current methods in use at the laboratory, indicate the possibility of some form of an acid digest followed by atomic absorption spectrometry ("**AAS**") or x-ray fluorescence ("**XRF**") finish.

Of the 102 verification samples collected by Metorex, 93 were submitted to the SGS Lakefield Research Africa Laboratory ("**Lakefield**") in Johannesburg for sample preparation and assaying for %TCu and %TCo. Setpoint Laboratories ("**Setpoint**") was used as the umpire facility for 11 pulps prepared at Lakefield. Both laboratories were South African National Accreditation System ("**SANAS**") accredited for ISO 17025 base metal analyses by XRF at the time of the analyses in December 2004.

The samples were prepared at Lakefield by weighing 0.3 g of the sample, roasted and mixed with 7.5 g of potassium pyrosulphate. The mixture was then fused, ground and then pressed into a pellet for XRF. The 11 check samples sent to Setpoint were also analysed by pyrosulphate fusion XRF method.

Samples from the 2005/6 Metorex drilling campaign were analysed by Genalysis laboratory in Perth and Lakefield in Johannesburg was used as the check laboratory. The Genalysis laboratory in Perth is accredited by the National Association of Testing Authorities, of Australia and has a strong internal QA/QC system using repeats and blanks.

A total of 4 600 RC samples and 600 diamond core samples were air freighted to Genalysis in Perth and analysed for % TCu and % TCo.

The Genalysis analytical methodology involved total dissolution, using four acids, of a 0.5 g sample split, followed by AAS. The accuracy of the assay results was 0.01% for both % TCu and % TCo.

The analyses for Acid Soluble Copper ("% **ASCu**") and Acid Soluble Cobalt ("% **ASCo**") were conducted only for samples above 1.5 % TCu and / or 0.15 % TCo. The samples were subjected to a three hour sulphuric acid leach of a 0.5 g sample followed by AAS. The accuracy of the assay results was 0.01% for both %TCu and %TCo.

The Ruashi Phase II Laboratory was commissioned in Lubumbashi in January 2009 and has been used for the analyses of samples since the 2009 Metorex drilling campaign.

The Robinson International Laboratory ("**Robinsons**") in Lubumbashi is used as a checking facility.

The Ruashi Phase II Laboratory was not an accredited assay facility during the analyses of the samples, while Robinsons was accredited to a SANAS standard in January 2010, but was under accreditation review during the period of the sample analyses, between January and June 2009.

The samples were analysed for % TCu, % ASCu, % TCo, % ASCo, % Fe, % Mn, % Al. Repeat analyses were carried out by the Ruashi Laboratory on all samples greater than 2 % TCu to a maximum of 15% of the sample batch. If there were a large number of high copper samples in a batch, samples for re-assay were randomly selected.

Sample analytical methods adopted at Robinsons were:

- % TCu and % TCo analysis was carried out by total dissolution using an aqua regia digestion of a 0.5 g sample, then made up into a 250 ml aliquot and read directly on the inductive coupled plasma ("**ICP**") XRF instrument.
- Analyses for % ASCu and % ASCo were carried out by dissolving a 0.5 g sample using a sulphuric acid with sodium metabisulphite ("**SMBS**") digestion. The sample was agitated intermittently for six hours, then made up to 250 ml before being read directly on the ICP XRF.

3.6.4 Quality assurance and quality control

[SR2.1, SR3.1, SR3.2, SR4.1]

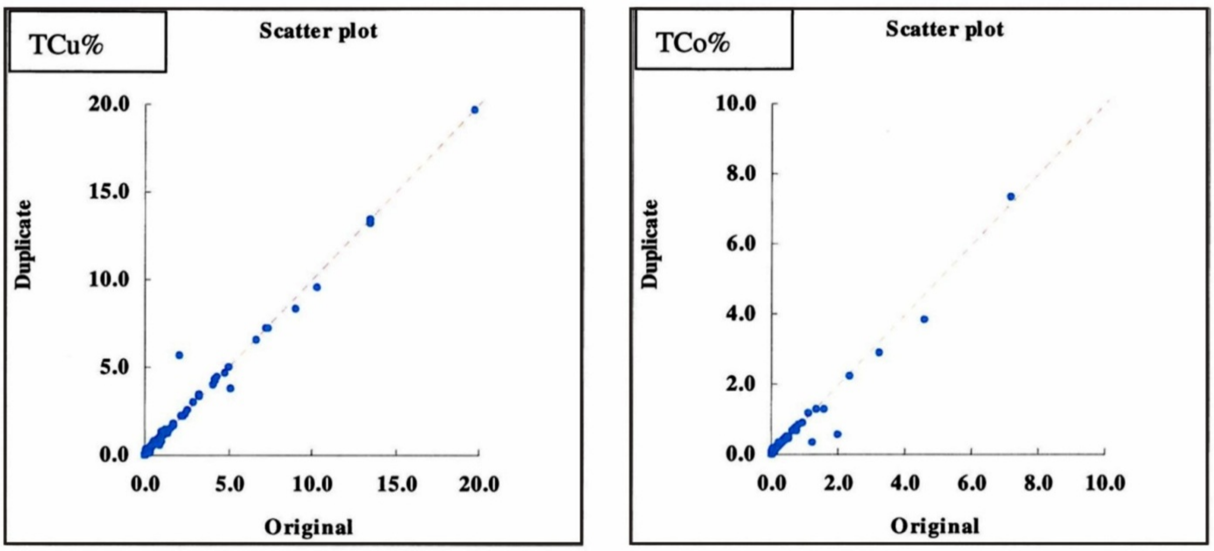
There is no information available on whether any QA/QC was undertaken on the UMHK / Gécamines sample database.

For the 2005/6 drilling campaign, Metorex instituted QA/QC protocols which included:

- Insertion of a blank sample in the sample stream after every 50 samples;
- field duplicates samples inserted in the sample stream after every 25 samples;
- pulp duplicates for every 25 samples was sent to umpire laboratory facility.

A total of 160 pulps prepared by Genalysis were submitted to Lakefield for % TCu and % TCo, and 47 for % ASCu and % ASCo.

Scatter plots of the results from the QA/QC analyses of duplicates samples from the 2005/6 drilling campaign (Figure 3.9) indicate good correlation between the Genalysis and Lakefield laboratory facilities.



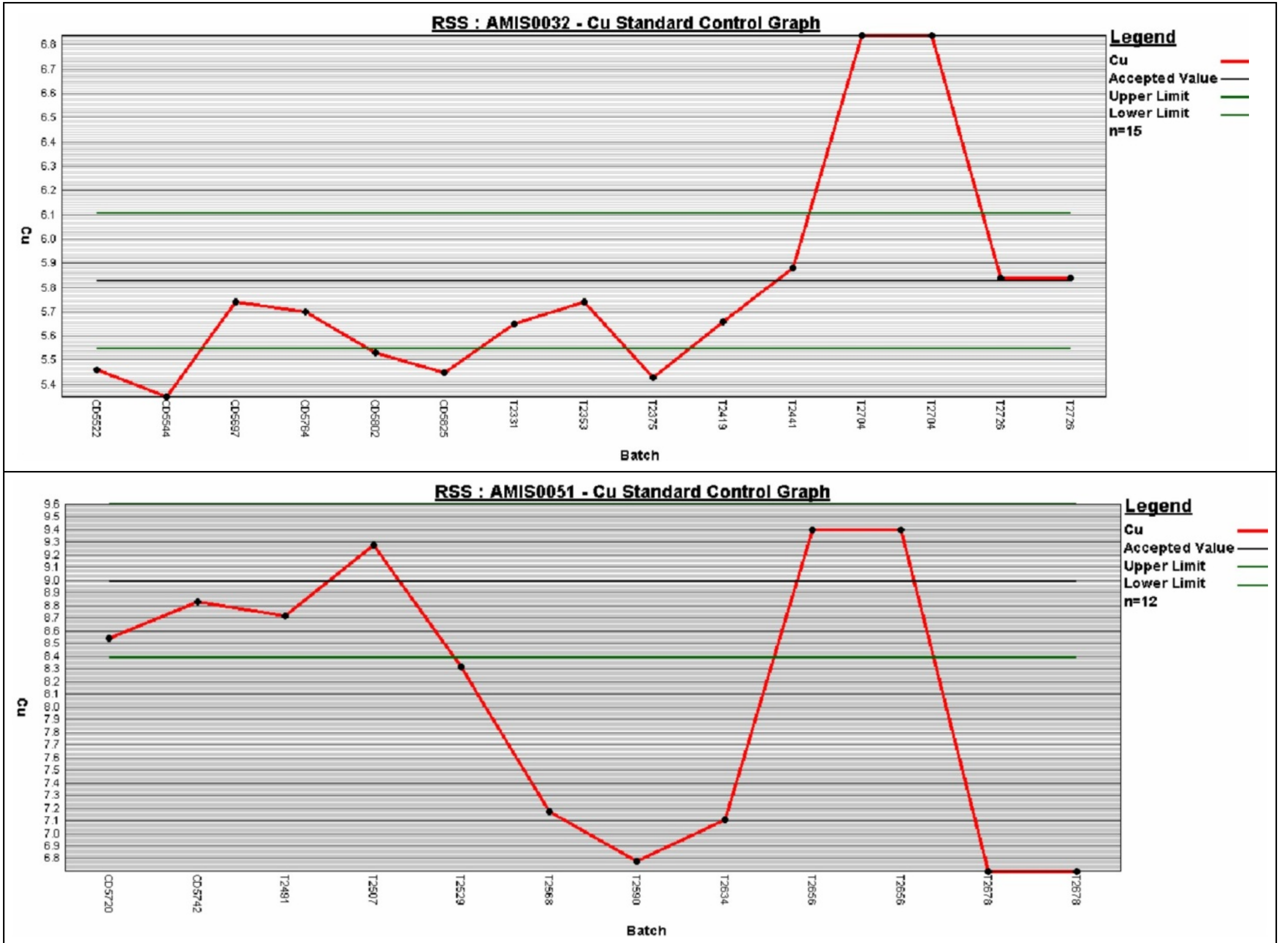
srk consulting	**Metorex** Scatter plots of TCu and TCo assays for field duplicates taken during the Metorex 2005/6 drilling campaign at Ruashi	Project No. 453459

Figure 3.9: Scatter plots of TCu and TCo assays for field duplicates taken during the Metorex 2005/6 drilling campaign at Ruashi

Since 2009, all samples were submitted to the Ruashi Analytical Laboratory with check assaying carried out by Robinsons. The QA/QC protocols in place were similar to the 2005/6 campaign, with slight modifications:

- Blanks and field duplicates were inserted every 10 samples;
- Certified Reference Materials ("**CRM's**") obtained from African Mineral Standards ("**AMiS**") of Johannesburg South Africa were inserted every 15 samples.

Analyses of %TCu of the CRMs at the Ruashi laboratory are shown in Figure 3.10.



srk consulting | **Metorex** % TCu analyses of CRMs at Ruashi Laboratory | Project No. 453459

Figure 3.10: % TCu analyses of CRMs at Ruashi Laboratory

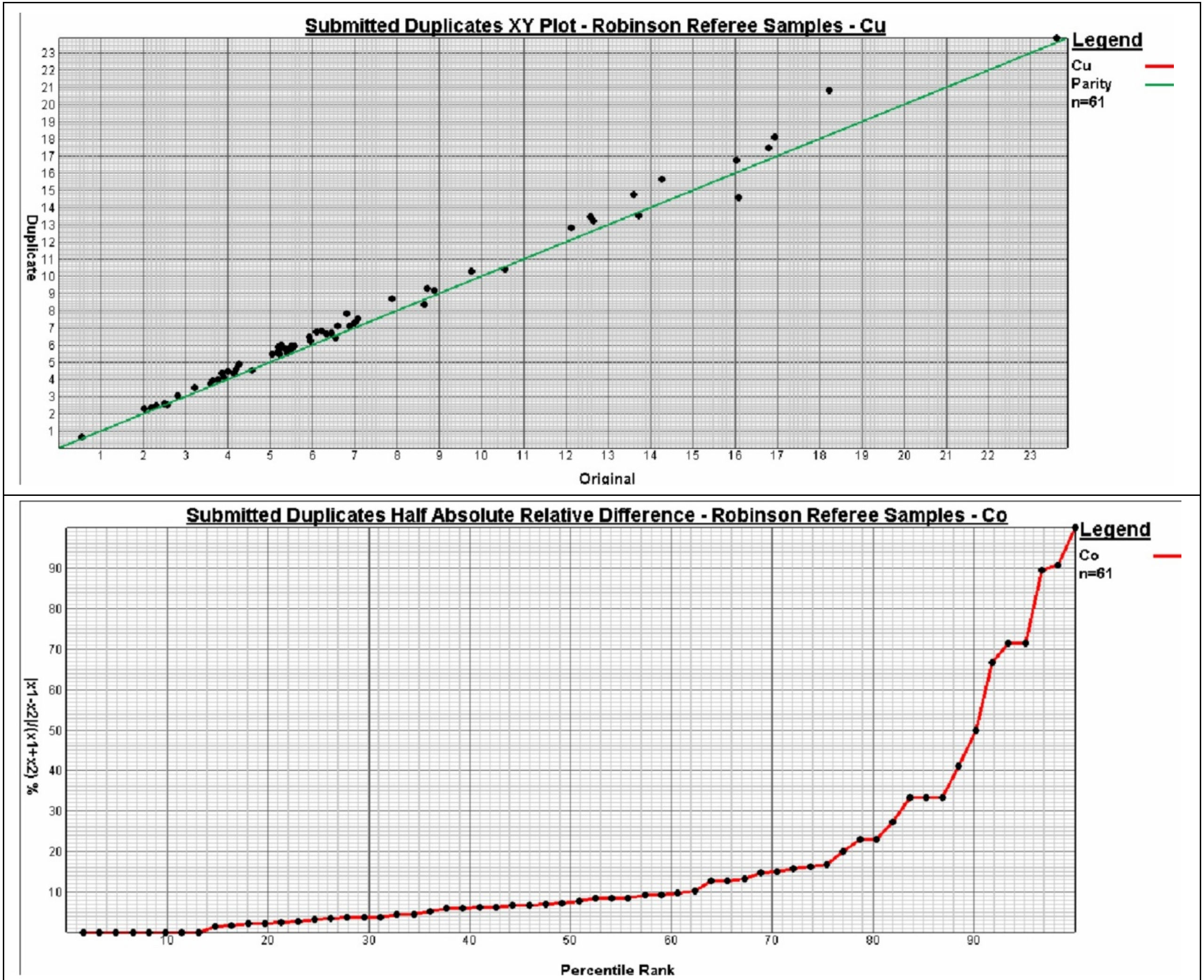
The plots of the %TCu analyses of CRMs in Figure 3.10 show periods where the assay results are significantly outside of the standard acceptable range. The validity and accuracy of the %TCu assay results that have been used in the geological database may be questionable.

The results of the pulp duplicates sent to the Robinsons laboratory plotted against the original sample assay results are shown for %TCu and %TCo in Figures 3.11 and 3.12 respectively. The Half Absolute Relative Difference ("**HARD**") plots of the Robinson referee samples for %TCu and %TCo are also shown in Figures 3.11 and 3.12 respectively.

From the analyses of QA/QC samples from the 2010 drilling, Integrated Geological Solutions (Pty) Ltd ("**IGS**") of Johannesburg concluded the following:

- **blanks:** There was a moderate level of contamination of the blanks.
- **internal laboratory duplicates**: duplicate precision within the laboratory is generally good. Copper has more than 90% better than 10% repeat precision. Cobalt is not as good with 86% better than 10% repeat precision. No external duplicates were submitted.

- **CRMs:** on the basis of the few certified standards submitted, the results from the Ruashi laboratory indicated a marked deviation from the accepted values.



srk consulting	Metorex Scatter and HARD plots for referee samples - %TCu	Project No. 453459

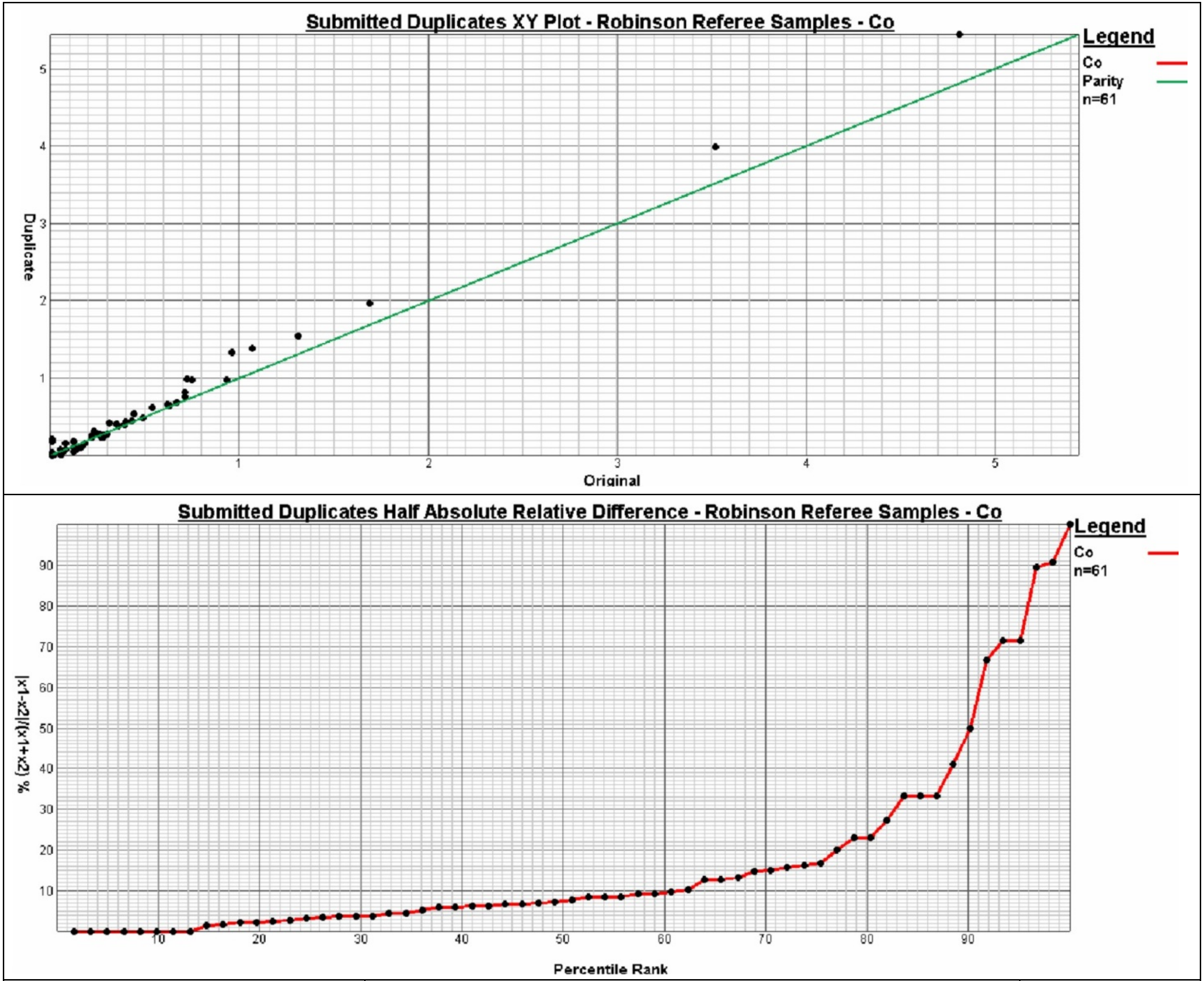
Figure 3.11: Scatter and HARD plots for referee samples - %TCu

- **referee samples**: All of the % TCu referee samples send to Robinsons showed better than 10% repeat precision. Cobalt was less precise.

IGS made the following conclusions with respect to the QA/QC on the Ruashi dataset:

- The 2005/6, 2009 and 2010 sampling programmes have had the appropriate QA/QC procedures in place. Independent audits of these procedures and the results have demonstrated that Ruashi Mining and Metorex have used these procedures to identify and re-assay samples and sample batches that fall outside acceptable industry assay quality norms.
- In their opinion, Metorex and Ruashi Mining have demonstrated due diligence and care in the drilling, sampling and assay of all drilling campaigns since 2005.
- However, the lack of a robust QA/QC audit trail for the historical UMHK and Gécamines data used for the resource modelling is flagged as an area of non-compliance to the SAMREC Code. Check sampling of old core by Metorex in 2004 indicated a reasonable correlation between historical UMHK / Gécamines data and check assays.
- While assays for this check sampling programme were assayed at an accredited laboratory and all the necessary QA/QC procedures were in place for this programme to ensure compliance with the SAMREC

Code, the number of check samples compared to the total database is very small (approximately 0.6%) and was biased towards samples collected in the 1970s and 1980s.



srk consulting	**Metorex** Scatter and HARD plots for referee samples - %TCo	Project No. 453459

Figure 3.12: Scatter and HARD plots for referee samples - %TCo

Metorex has accepted the historical data as suitable for mineral resources estimation work on the basis of this limited check sampling, and the results of the 2005/6 and 2009 drilling, even though the majority of the database is not supported by adequate QA/QC. However, Ruashi mine is a mature producing entity and the copper production over the years has shown consistency with the predictions of the drill hole database. This consistency in copper production largely mitigates the insufficient QA/QC so that the quality of the resources as classified can be accepted.

The areas where mining is being done at present are supported by drilling on a 25m x 25m drill spacing with good QA/QC. These resources/reserves should be sufficient for the next 4-5 years. The IGS comments remain a concern and Ruashi would be advised to conduct regular reconciliations between planned and actual metal content.

It is essential that the assay quality control programme instituted at the Ruashi Mine laboratory be strictly adhered to as a means of improving the confidence in all new assay results received. The Ruashi Mine geological and analytical laboratory staff have received training in this respect, and a procedure is in place to ensure all drill hole samples to be used for estimation purposes, are accompanied by the appropriate level of blanks, CRM and repeat samples to ensure compliance.

3.6.5 Bulk density and bulk tonnage data

[SR2.4]

Bulk density measurements were taken on 1 168 samples from the 2009 drilling programme across lithological domains and across a range of depths, and were measured on air dried samples. Because some black ore mineral zone **("BOMZ")** core samples would actually float on water, a dry medium (sugar) was used to calculate the volume with weight measured using a digital scale. During 2010, a standard SNOWRIX model NHV-3 digital density scale was used for all the "non-floating" rock density measurements.

Plots of grade versus SG and depth versus SG were created for the different domains but no discernible trend was evident. An average density was used for each domain and the mixed zone was assigned a value midway between the oxide and sulphide values. The dolomitic units generally have a higher density than shale, and the BOMZ shows low to very low density. The sulphide densities average 2.5 t/m^3. Table 3.4 shows 2009 and 2010 densities.

Table 3.4: Average specific gravity by geological domain and weathering characteristics

Ore Type	Oxide		Mixed		Sulphide	
	2009	2010	2009	2010	2009	2010
CMN	2.03	2.06	2.25	2.11	2.5	2.28
Mineralised CMN	2.03	2.06	2.25	2.11	2.5	2.28
BOMZ	1.78	1.81				
SD	1.92	2.03	2.25	2.21	2.57	2.39
Mineralised SD	1.92	2.03	2.25	2.21	2.57	2.39
DSTRAT / RSF	2.17	2.07	2.35	2.37	2.52	2.67
RSC	2.12	2.15	2.32	2.43	2.51	2.5
MV	2.13	2.23	2.34	2.45	2.54	2.66

The waste rock density was based on the data from 2006 drilling. A relationship established between density and depth was applied in the definition of waste densities in the model, subject to a maximum value of 2.7 t/m^3.

3.6.6 Geological Modelling and Zones of Mineralisation

[SR4.1A(ii)(iv), SR4.1A/B, SR4.2A, SR4.2B]

The geological model for the Ruashi Mine was constructed on the basis of identification of major lithological units and the merger of thinner and discontinuous units to ensure continuity across the drill holes consistent with the major structural features including geological discontinuities.

The main geological features identified are a recumbent fold with flat lying and vertical faults causing stretching and fragmentation into three parts resulting in the Ruashi I, II and III ore bodies. Depth of oxidation and weathering intensity vary depending on the rock types. Depth of weathering varies from 50 m to 300 m below surface.

The lithological units modelled are listed in Table 3.5.

Table 3.5: Summary of modelled lithological units (IGS report)

Unit	Description	Thickness, m
MV	Modelled as a singular unit at the base of the ore body	3 to 8
RSF/DSTRAT	Modelled as a combined unit	5 to 20
RSC	Modelled as singular unit	12 to 25
SDS and SDB	Modelled as a singular unit called the SD unit	60 to 95
BOMZ	Modelled as a singular unit called the BOMZ	3 to 20
Mineralised CMN	Modelled as a mineralised zone on the footwall side of the unit within the broader CMN envelope – not clear	2 to 30
Breccias	Modelled as distinct units around Ruashi II	N/a

3.6.7 Mineral Resources estimation

[SR4.2]

Mineralised zones were defined within the lithological units on the basis of a 0.5% TCu or 0.1% TCo cut-off.

On the basis of the observations in Ruashi I and coupled with the additional data from the 2009 to 2012 drilling, the oxide oxide-sulphide interface was re-defined and included a 10 m transition or mixed zone. The transition zone was observed to be relatively shallow in the Ruashi I area deepening towards the east, where in Ruashi III, the oxide-sulphide interface is roughly 200 m deep.

For the mineral resource modelling, the mineralised envelopes were further split into oxides and sulphides zones and modelled and estimated separately. This was based on the improved geological and structural understanding from the 2009 to 2012 drilling and surface mapping.

Samples within the mineralised envelopes and below the June 2009 mining surface topography were composited to 2 m lengths and categorised according to the lithology and oxide-sulphide domains (Table 3.6). IGS stated that the exclusion of samples above the June 2009 surface was done to minimise the effect of "smearing" of HGs from the supergene zone (mined out by Gécamines).

Table 3.6: Summary Statistics for 2 m composites for all geological domains

UNIT	Oxide					Sulphide				
	No. of Comps	Mean %TCu	Mean %TCo	%TCu Cap [1]	%TCo Cap [1]	No. of Comps	Mean %TCu	Mean %TCo	%TCu Cap [1]	%TCo Cap [1]
MV	704	6.85	0.5	25.75	3.63	325	4.11	0.48	16.9	3.52
RSF / DTSRAT	716	2.99	0.49	17.7	3.52	284	1.74	0.28	12.06	1.74
RSC	1 045	1.41	0.3	9.58	2.39	327	1.51	0.21	12.98	1.22
SD	2 871	0.93	0.19	8.5	2.07	474	0.4	0.06	8.01	0.51
SD_MIN	1 873	2.82	0.65	14.24	5.06	124	3.3	0.51	23.65	3.79
BOMZ	808	2.96	0.52	17.34	4.13	317	0.48	0.04	2.77	0.38
CMN	4 215	1.67	0.12	9.98	1.23	5	1.33	0.25	10.23	0.42
CMN_MIN	967	3.27	0.17	14.55	1.41	325	4.11	0.48	16.9	3.52
BRECCIA	238	1.93	0.09	12.93	0.95					

[1] Capping is based on the 98 Percentile for each variable

The sample data is too exhaustive to be included in the CPVR. The table of statistics is included to show the range of values intersected within the samples selected for resource estimation. In the case of the Ruashi Mine, this is a mature operation that has a history of production and that mitigates the requirement for drillhole intersections to be included.

IGS commented that oxide grades are generally higher than sulphide grades, possibly indicating enrichment in the oxide zone.

For the estimation, IGS capped the % TCu and %TCo values based on the 98th percentile value. For example, the highest composite value for the MV oxide was 36% TCu, but for estimation, the highest value used was the cap value of 25.75% TCu.

IGS indicates that this was done to avoid assigning undue influence to the highest grade values.

Ordinary kriging with omni-directional variograms were used in the estimation for the December 2010 model. According to IGS, directional variograms were attempted, but due to limited data were not developed.

IGS reported the following for each of the omni-directional variograms:

- A two structure variogram was modelled in each case, with a first structure with a range of the order of 8 m-31 m, and a second structure with a range of between 43 m-89 m;
- The nugget was modelled on the down-the-hole data and nugget effect levels were generally 20%-30% of the population variance;
- Most of the variance is described by the nugget and first structure of the variogram; and
- 'Smoother' variograms were generally obtained in populations with larger numbers of composites.

Block model parent dimensions of 25 m x 15 m x 10 m in the X, Y and Z directions respectively were used to fill in the mineralised zones with sub-blocking to allow for the accurate definition of the mineralised volumes.

The estimation was undertaken independently for each domain and for each variable based on the respective 2 m composites and the omni-directional variogram. Exceptions to this were:

- In certain sulphide domains where the number of composites was very small, the oxide variogram was used.

- The transitional zone which was estimated using the combined oxide and sulphide datasets for that stratigraphic domain.

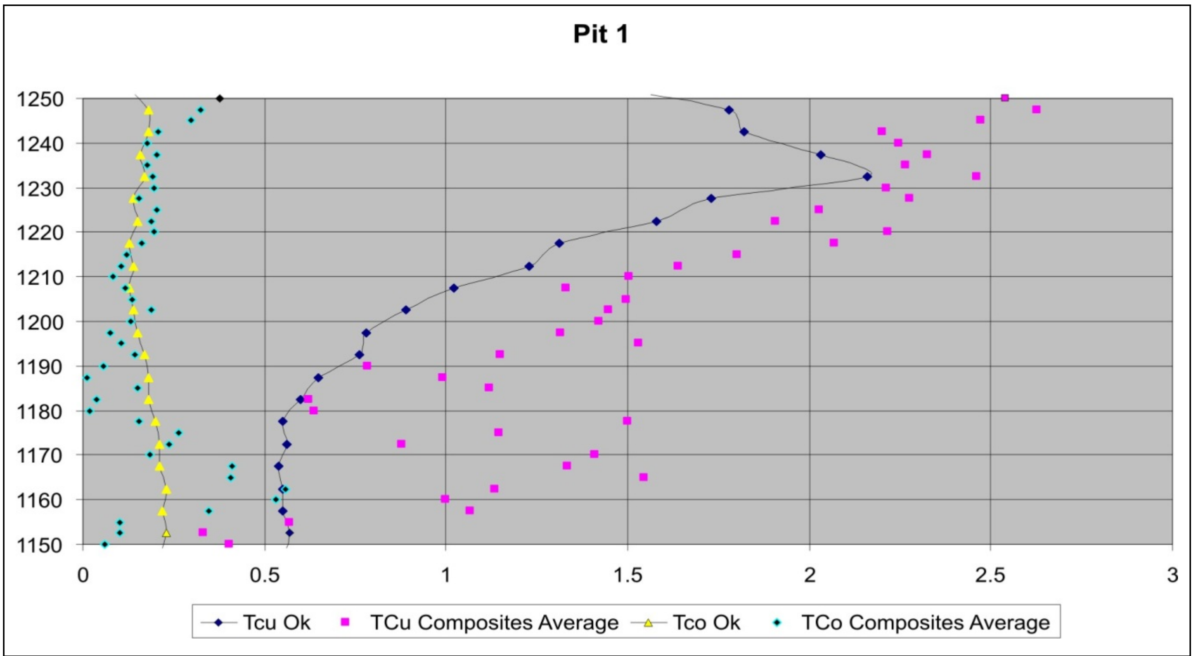
A search neighbourhood just beyond the variogram range (1.1 x the variogram range) was used in the first pass estimation. A second estimation was carried out to fill the modelled units beyond the variogram range with estimated grades. All blocks estimated beyond the variogram range were classified as Inferred Resources.

A maximum of 20 composites was used to estimate a block with the minimum number ranging from 4 to 10, depending on the domain estimated. Thinner units such as the MV required a lower minimum be used since a single drill hole may have only a small number of composites.

Due to limited % ASCu and % ASCo data within the dataset, the % ASCu and % ASCo values were assigned based on average solubility ratios for the oxide, transitional and sulphide zone. % ASCu and % ASCo values in the oxide zone were assigned 90% of the total copper and cobalt values estimated for the block. Similarly in the transition zone, 50% acid solubility was assigned and 10% in the sulphide zone.

3.6.8 Validation of estimates

IGS validated the estimates by comparing the averages of the model grades within 10 m vertical slices with that of the composites in the same slice. The comparisons for Ruashi I are illustrated in Figure 3.13.



srk consulting	**Metorex** Comparisons of model grade and composite grade averages for Ruashi I	Project No. 453459

Figure 3.13: Comparisons of model grade and composite grade averages for Ruashi I

On average the % TCu block estimates in Ruashi I are consistently lower than the average composite values. IGS considered that the % TCo estimates on the other hand are smoothed.

IGS indicated that there is a reasonable correlation for % TCu between the estimates and composites for Ruashi II, but for Ruashi III, the estimates are consistently higher than the composites below 1 200 m elevation.

The validations for % TCo in Ruashi II and Ruashi III are similar to that observed in Ruashi I.

3.6.9 Mineral Resources Classification

[SR5.7B, SR7]

IGS considered the drill hole spacing of the Ruashi data at 50 m x 25 m to be adequate to classify the mineral resources into either Indicated or Measured categories using the variogram range as a guide.

Other factors considered in the classification include:

- The bulk of the data used in the mineral resource estimation comes from an old dataset where no demonstrable quality assurance measures were implemented;

- The assay technique used for the early drilling is uncertain, and only small parts of the core were stored for lithological reference;
- Historical geological and assay logs of the UMHK / Gécamines drill holes were of variable quality and in some instances almost illegible. In many cases no rock type or core recovery information was recorded;
- IGS classified the oxide in Ruashi I and II and within the lithological units MV, RSF and DSTRAT into the Measured Resources category, largely on the observed continuity of the lower ore body in Ruashi I and II together with the mapping of the ore body, the recent well controlled drilling.

IGS applied the following classification to Ruashi:

- The block estimates of the oxidised mineralisation within the lithological units MV, RSF and DSTRAT in Ruashi I and II were classified as Measured Resources largely on the observed continuity of the lower ore body in Ruashi I and II together with the mapping of the ore body and the recent well controlled drilling.
- The remainder of the block estimates within the oxidised zones in Ruashi I, II and III (with the exception of the CMN unit) were classified as Indicated Resources;
- The nature of the mineralisation within the CMN unit in Ruashi I and II was not well understood and therefore the estimates were downgraded to Inferred Resources;
- The sulphide mineralisation in Ruashi I and Ruashi III was the subject of infill drilling from 2010 to 2012, allowing for the better drilled areas to be re-classified into the Indicated Resource category and the remainder in the Inferred Mineral Resources category.

3.6.10 Cut-off grade determination for 2012 Mineral Resources Estimates

[SR5.7B(ii), SR5.7C(iii)]

The parameters used by Metorex for the grade cut-off determination for reporting of Mineral Resources at the Ruashi Mine are set out in Table 3.7.

Table 3.7: Ruashi – parameters for cut-off determination for mineral resources

Parameter	Units	Values for Cu cut-off	Values for Co cut-off
Unit costs			
Time cost	(USD/t)	39.20	39.20
Processing	(USD/t)	32.33	32.33
Element processing cost	(USD/t metal in feed)	200.00	2 430.00
Selling costs	(USD/t metal produced)	653.00	2 220.00
Mine call factor	(%)	100.0%	100.0%
Dilution	(%)	1.0%	1.0%
Processing recovery	(%)	90.0%	80.0%
Revenue	(USD/t)	12 000	33 069
Royalty	(%)	4.0%	4.0%
Payability (% of LME)	(%)	100%	70%

A cut-off grade of 0.78% TCu or 0.62% TCo results from these parameters.

The method used to determine the cut-off grades is consistent with industry practice and the cut-off grades thus determined are seen to be reasonable.

3.6.11 Audited Mineral Resources and Mineral Reserves

[SR9]

The Ruashi open pit Mineral Resources in Table 4.8 are reported based on a 20 June 2013 pit survey and within an optimistic economic Whittle pit shell above a cut-off grade of 0.78% Cu or 0.62% Co. The Mineral Resource estimates are deemed to be correct at 30 June 2013 and are quoted inclusive of the Mineral Reserves.

The Mineral Reserves within each practical pit were determined after the inclusion of 1% mining dilution and 0% mining losses at a 1.23% CuEq cut-off grade within an economic pit based on a Cu price of USD8 000/t. The reserves were further classified into Proved and Probable Reserves in accordance with the Guidelines of the SAMREC Code, as presented in Table 3.8. The Mineral Reserves in Table 3.8 have been audited by SRK and are seen to be acceptable.The discussion on the conversion of Mineral Resources to Mineral Reserves and the mine modifying factors used in the conversion is given in Section 3.9.

Table 3.8: Ruashi Mine – SRK Audited Mineral Resources and Mineral Reserves at 30 June 2013 at 0.78% Cu or 0.62% Co cut-off

Resource Classification	Mineral Resources (@ 0.78% Cu or 0.62% Co cut-off) Tonnes (Mt)	Cu Grade (%)	Copper (kt)	Co Grade (%)	Cobalt (kt)	Reserve Classification	Mineral Reserves (@1.23% CuEq cut-off) Tonnes (Mt)	Cu Grade (%)	Copper (kt)	Co Grade (%)	Cobalt (kt)
Oxide Material (in LoM Plan)						**Oxide Material (in LoM Plan)**					
Measured	0.7	4.71	34.7	0.26	1.9	Proved	0.3	6.12	19.7	0.26	0.8
Indicated	14.4	2.30	331.0	0.36	52.1	Probable	11.5	2.73	312.4	0.46	53.2
Inferred	6.1	1.00	61.6	0.10	6.3						
Total	**21.3**	**2.01**	**427.3**	**0.28**	**60.3**	Total	11.8	2.82	332.1	0.46	54.1
Surface Stockpiles (in LoM Plan)						**Oxide Material (Surface Stockpiles)**					
Indicated	1.0	1.21	11.9	0.41	4.0	Probable	1.0	1.21	11.91	0.41	4.05
Inferred											
Total	**1.0**	**1.21**	**11.9**	**0.41**	**4.0**	Total	**1.0**	**1.21**	**11.9**	**0.41**	**4.0**
Surface Tailings Dams (in LoM plan)						**Surface Tailings Dams**					
Indicated	0.3	1.80	5.4	0.41	1.2	Probable	0.3	1.80	5.4	0.41	1.2
Inferred	0.5	1.90	9.5	0.41	2.1						
Total	**0.8**	**1.86**	**14.9**	**0.41**	**3.3**	Total	**0.3**	**1.80**	**5.4**	**0.41**	**1.2**
Total Oxide Material	**23.0**	**1.97**	**454.1**	**0.29**	**67.6**						
Sulphides in ultimate pit											
Indicated	0.0	1.24	0.2	0.37	0.1						
Inferred	0.9	3.91	34.0	0.33	2.9						
Total in-pit Sulphides	**0.9**	**3.86**	**34.1**	**0.33**	**2.9**						
Sulphide below ultimate pit											
Indicated	2.9	1.78	51.5	0.44	12.7						
Inferred	6.5	2.86	185.3	0.28	18.1						
Total UG sulphides	**9.4**	**2.53**	**236.8**	**0.33**	**30.9**						
Total Sulphide Material	**10.3**	**2.64**	**270.9**	**0.33**	**33.8**						
Oxides + Sulphides Material											
Measured	0.7	4.7	34.7	0.26	1.9						
Indicated	18.6	2.15	400.0	0.38	70.2						
Total Measured and Indicated	19.3	2.25	434.7	0.37	72.1						
Inferred	14.0	2.08	290.4	0.21	29.4						
Total Mineral Resources	**33.3**	**2.18**	**725.0**	**0.30**	**101.4**	**Total Mineral Reserves**	**13.05**	**2.68**	**349.4**	**0.45**	**59.3**

3.6.12 SRK Comments

SRK's comments are based on the review of the drill hole data and the block model provided. As part of the audit process, SRK undertook a site visit to the Ruashi Mine in October 2012.

The drill hole data was provided as a Microsoft Access database from which the collar, geology, survey, sampling, core recovery stratigraphy and density worksheets were extracted for the creation of a drill hole database in Datamine.

The block model and geological surfaces were provided in Surpac format, easily imported into Datamine software.

The drill hole sample data were not coded to reflect samples falling within the zones of mineralisation. Also the actual composite files used in the estimations were not provided. In this regard, SRK could not validate the block estimates against the composites.

In this review, SRK examined:

- The quality of the grade estimates with respect to the drill hole data through plan and section plots. Section plots are at 50 m intervals in the strike directions of the mineralisation, while plan plots are at 10 m intervals;
- The Mineral Resources classification with respect to the drill hole data distribution;

Selected plots are shown for Pit I (section plots in Figure 3.14 and level plots in Figure 3.15) and for Pit III (section plots in Figure 3.16).

The plots show the colour coded % Cu grade block model with the drill holes superimposed and similarly, colour coded on % Cu. The drill holes are selected within 20 m on either side of the section line.

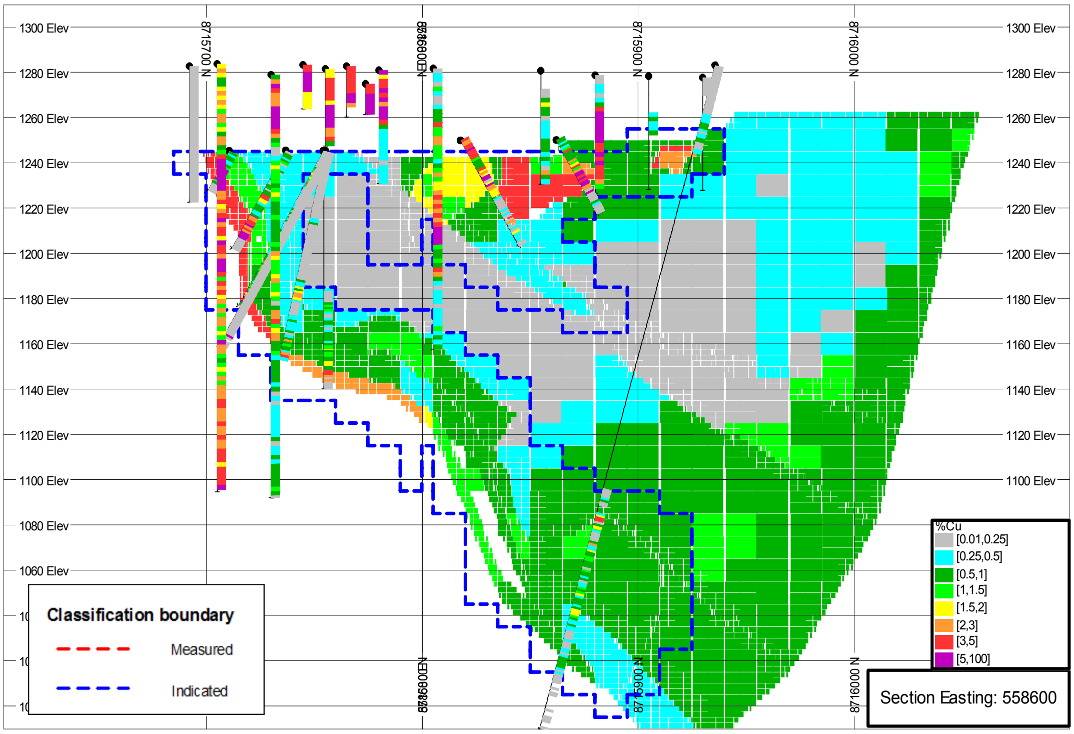
The outlines of the Measured and Indicated Mineral Resources are also shown as dashed red and blue dashed lines respectively. The block estimates falling outside of these two dashed lines are in the Inferred Mineral Resources category.

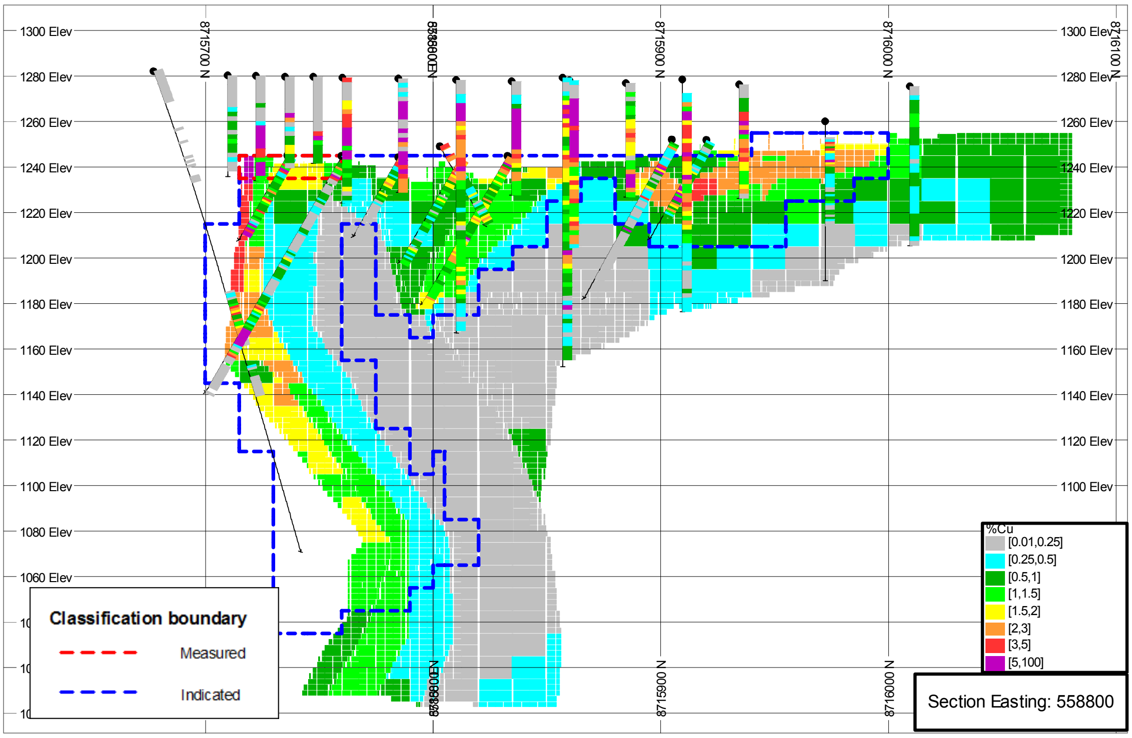
SRK makes the following observations from the review of the section and plan plots:

- There is limited data at depths below 1 160 m elevations in areas classified as Indicated Mineral Resources. The level plans show data coverage in the south due to the overfold and less so further to the north. The data coverage is very sparse in the extreme north-western portion of the mineralised zones shown on the level plans;
- A localised portion of the area defined as Indicated Mineral Resources in the north-west of Pit I appears to have been over projected at depth below the lowest drill hole intersection. Resources in this area are informed by data from the overfold, but the effect is limited;
- Drill holes are mostly vertical and, whereas in the supergene enriched zone in the north this is alright, in the steeply dipping limb of the mineralised zone, there is a high probability that a drillhole could be sampling the same lithological sequence within the zone of mineralisation and then these samples are used to estimate into the zone of mineralisation.

In view of these observations, SRK is of the opinion that there are risks associated with the quality of the estimates compared to the input data. The Indicated Mineral Resource classification over a localised portion of the north-west of Pit I is not supported by the limited drill hole coverage, but this represents a small proportion of the total Indicated Mineral Resources. There is limited data at depths below 1 160 m elevation.

SRK is of the opinion that any uncertainty with the quality of the estimates is reflected in the classification of the Mineral Resources as defined according to the SAMREC Code.





srk consulting	**Metorex** Ruashi Mine - Section plots of comparison of block and drill holes grade distributions in Pit I	Project No. 453459

Figure 3.14: Ruashi Mine - Section plots of comparison of block and drill holes grade distributions in Pit I

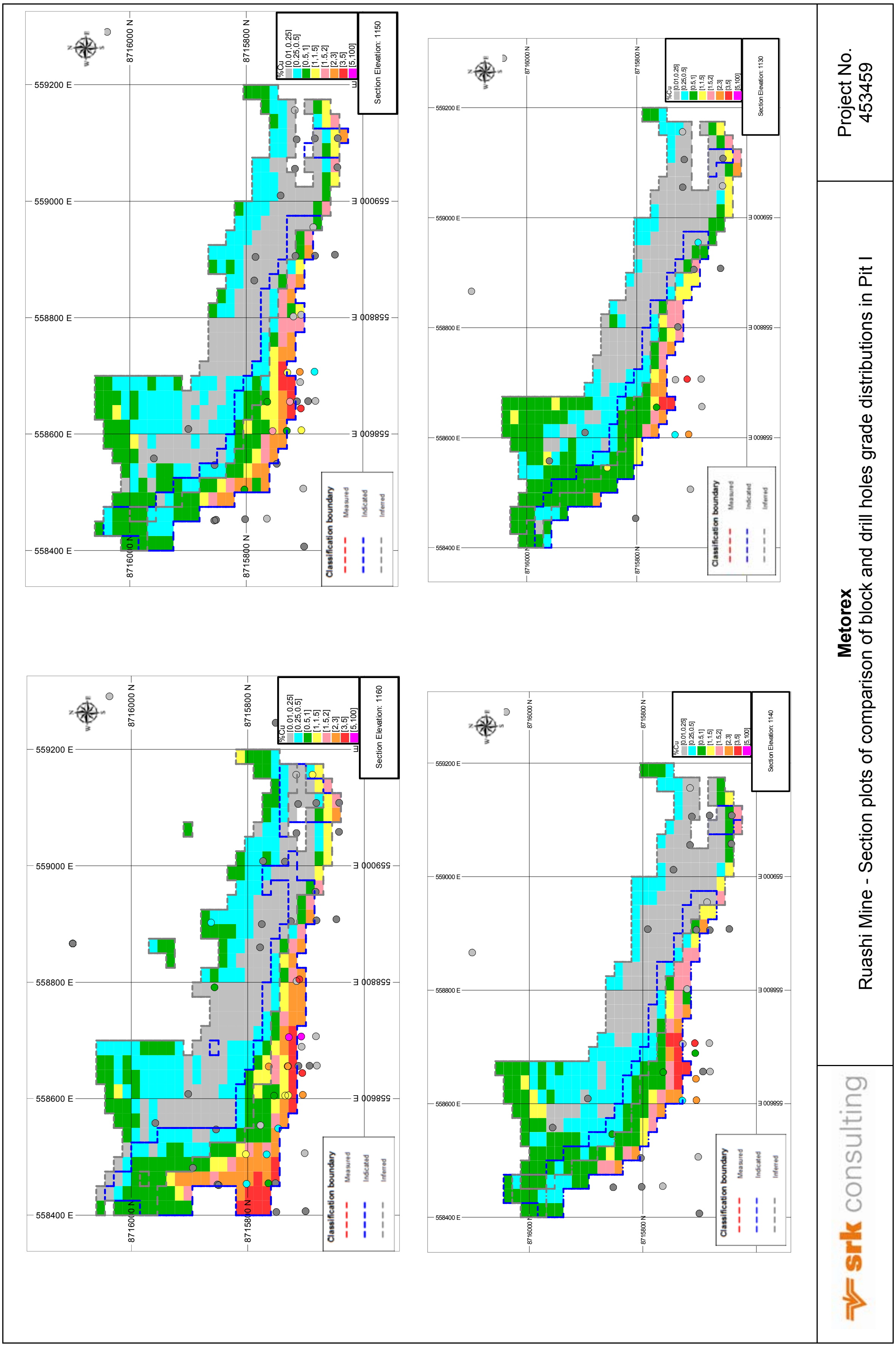
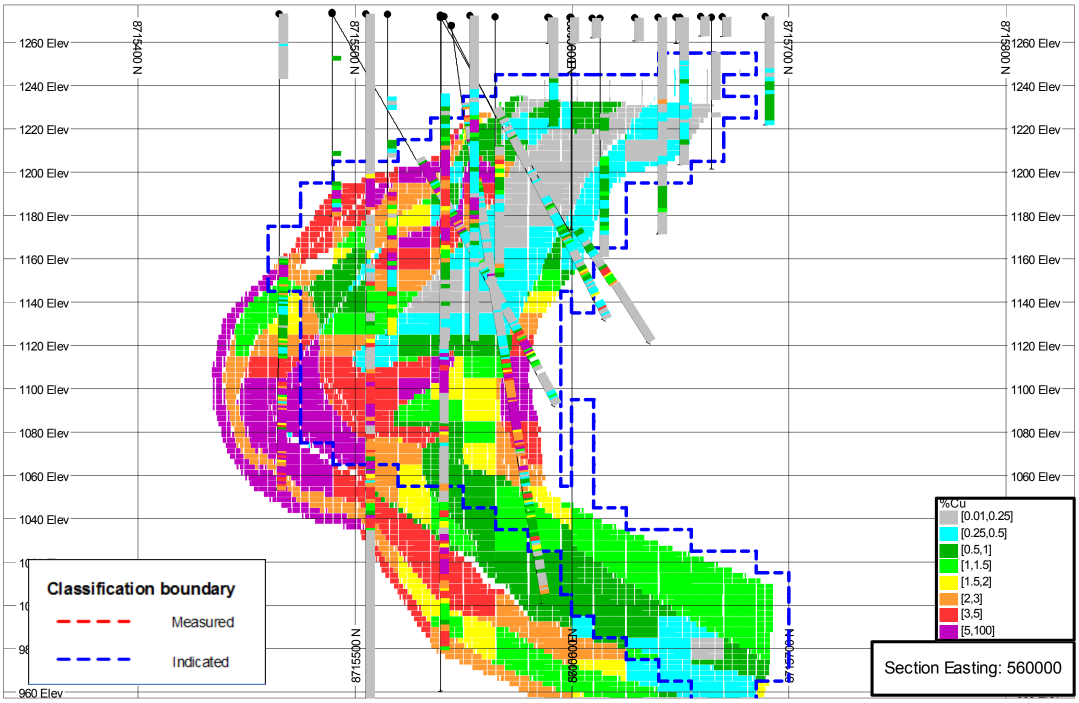
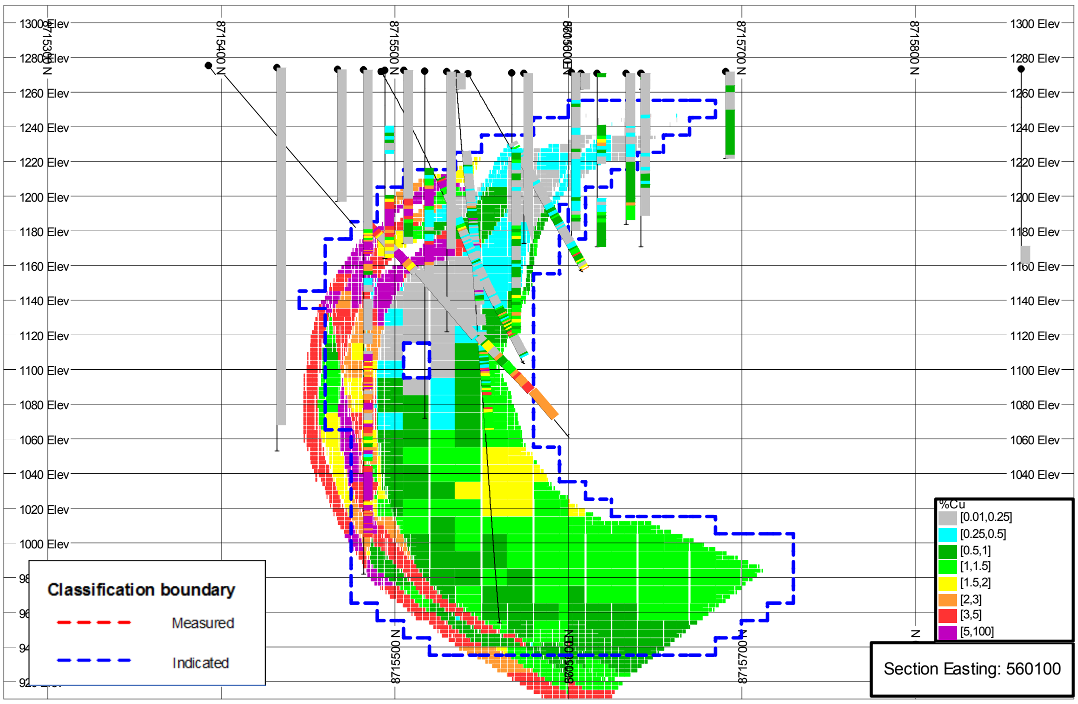


Figure 3.15: Ruashi Mine – Level plots of comparison of block and drill holes grade distributions in Pit I





srk consulting	**Metorex** Ruashi Mine - Section plots of comparison of block and drill holes grade distributions in Pit III	Project No. 453459

Figure 3.16: Ruashi Mine - Section plots of comparison of block and drill holes grade distributions in Pit III

3.6.13 Reconciliation of Mineral Resources and Reserves

[SR8B(iv), SR8C(vi)]

The previous Mineral Resources and Mineral Reserve statement for the Ruashi Mine was published by Metorex in its Annual Report for 2011. The Mineral Resources and Mineral Reserves at 31 December 2011 and at 30 June 2013 for the Ruashi Mine are compared in Table 3.9.

Table 3.9: Ruashi Mine – Mineral Resources and Mineral Reserves Reconciliation - 31 December 2011 to 30 June 2013

Item	At Jun 2013			At Dec 2011		
	Tonnes	Contained Metal		Tonnes	Contained Metal	
	(Mt)	Cu (kt)	Co (kt)	(Mt)	Cu (kt)	Co (kt)
Mineral Reserves						
Proved	0.3	19.7	0.8	0.7	37.0	2.0
Probable	12.7	329.7	58.5	14.6	407.0	64.0
Total Min. Reserves	13.1	349.4	59.3	15.3	444.0	66.0
Mineral Resources						
Measured	0.7	34.7	1.9	1.0	46.3	2.6
Indicated	18.6	400.0	70.2	25.5	562.4	99.4
Inferred	14.0	290.4	29.4	23.1	385.3	47.5
Total Mineral. Resources	33.3	725.0	101.4	49.6	993.9	149.4

The reliability of the geological data and resource estimates is reflected in the assigned classifications.

Historic performance and modifying factors for Ruashi are set out in Section 3.9.

The changes in the Mineral Resources and Reserves for the Ruashi Mine from December 2011 to June 2013 are attributed to:

- Mining depletion of 1.28 Mt in F2012 and 0.81 Mt in H1-F2013;
- Deep drilling below Pits I and II changed the geological interpretation and reduced the extent of the sulphide orebody at depth;
- A different cut-off grade based on changed techno-economic conditions (operating costs and metal prices) was applied to the Mineral Resources by Metorex (0.79% CuEq in December 2011, versus 0.78% TCu or 0.62% TCo for June 2013);
- Changed resource classification.

It should be noted that there were some 2.2 Mt of Inferred Mineral Resources that had been included in the initial LoM plan for Ruashi. It is normal in any mine plan to find that some Inferred Mineral Resources have to be extracted in the course of following the mining sequence. As this however is a material percentage of the LoM tonnage and the HKSE does not permit the valuation of Inferred Mineral Resources, the LoM plan was redone to be based on Measured and Indicated Mineral Resources only.

3.7 Rock Engineering

[SR5.4]

3.7.1 Geotechnical design considerations

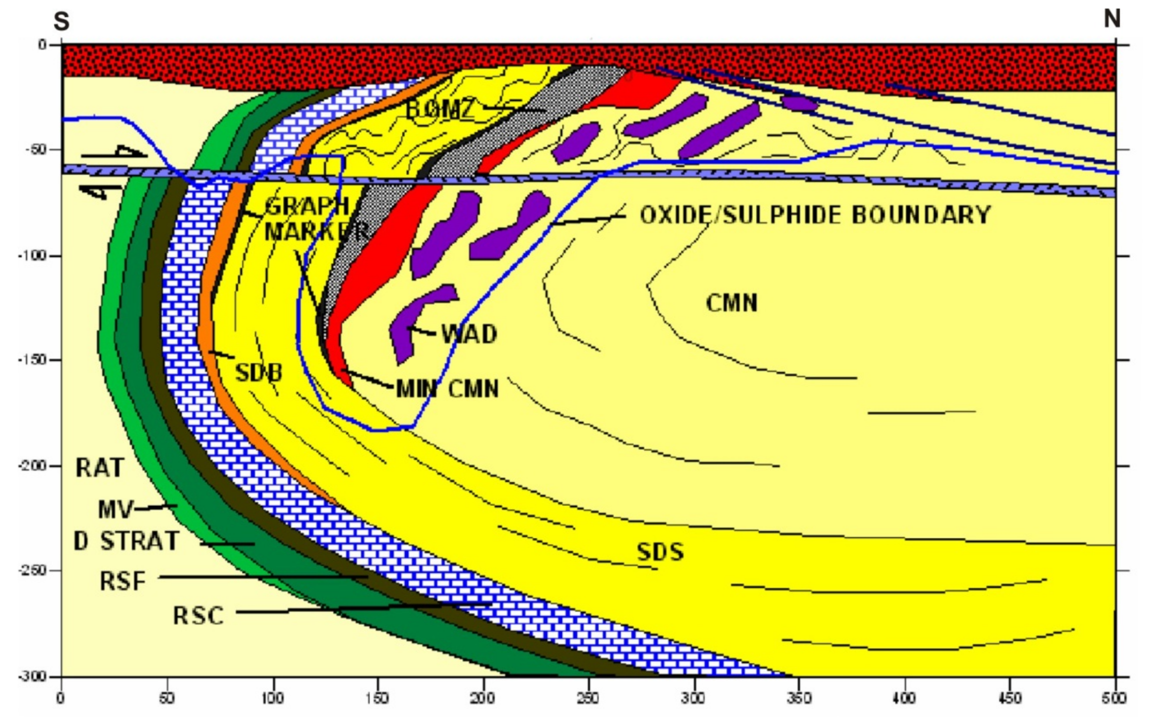
The Ruashi deposit lies in a complex structural geological environment typical of many DRC deposits. The local structural environment possibly results from a phase of anticlinal folding followed by lateral faulting. Consequently the pit footwall slope consists of RAT (geological footwall) dipping southwards into the face while the pit hanging wall slope consists mostly of CMN (geological hanging wall) strata dipping northwards, also into the face. This structure is illustrated in Figure 3.17.

Geotechnical information for use in pit design has been generated in a study undertaken by Open House Management Solutions ("**OHMS**") in June 2009 together with information from back analyses of failures in Pit I and Pit II, supplemented by a comprehensive geotechnical study entitled "Slope design for Ruashi Pit 2 and 3" by OHMS which was presented in October 2011. As with the 2009 study, the supplementary study has used data collected from drill hole core logging and laboratory sample testing to recommend optimal slope angles using numerical modelling. The locations of investigation holes used for the 2011 study are presented in Figure 3.18.

The slope geometry configuration applied to the 2009 and 2011 LoM planning process for the northern pit slopes of Ruashi I, II and III was based on the OHMS 2009 recommendations and remains unchanged. However, the southern pit slope configuration has undergone considerable changes to cater for the substantial thicknesses of saprolitic material, particulary talcose RAT, occurring there. Slope designs are summarised in Table 3.10.

Table 3.10: Ruashi Mine – Summary of slope design recommendations

Mining Horizon	Slope angle (°)		Indicative Slope height (m)
	OHMS recommendation	Implemented/Ruashi preferred	
Saprolites	22	22	75
Transition Zone	40 - 45	28	20
Fresh RAT	50 - 55	50 - 55	80
Overall slope angle (OSA)	30	29	175

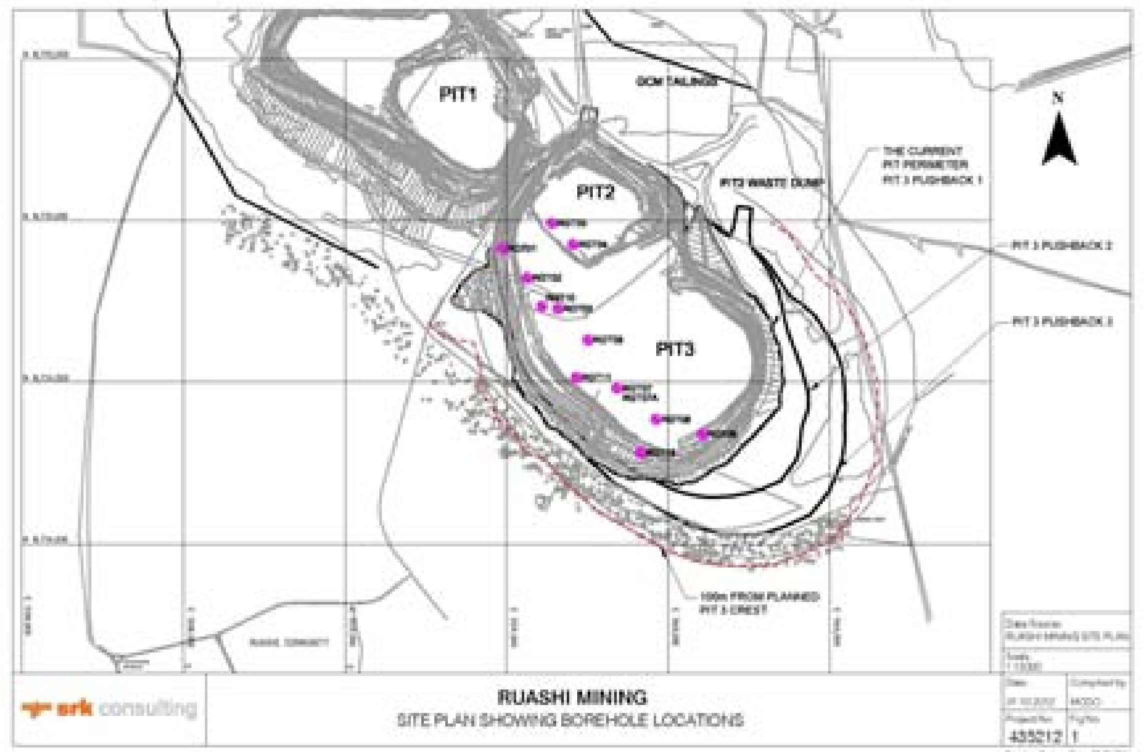


srk consulting	**Metorex** Geological section (S to N) illustrating the distribution of RAT and CMN strata relative to the ore body sequence	Project No. 453459

Figure 3.17: Ruashi – Geological section (S to N) illustrating the distribution of RAT and CMN strata relative to the ore body sequence

Design efforts to date have centred on the pit footwall in RAT. It has been assumed that similar designs can be applied to the pit hanging wall in CMN. In the DRC in general, the CMN sequence tends to contain more dolomite horizons which, when unweathered, are competent. Weathered CMN on the other hand can be very weak. It is recommended therefore that further geotechnical investigation is undertaken to characterise the hanging wall domain and confirm LoM designs.

An investigation into the likelihood of pit crest break back in near surface soils and saprolitic materials was undertaken by SRK in 2012 using information obtained from the OHMS 2010 report. The SRK report concluded that, given the highly variable nature of the material and the lack of data describing its long term behaviour, there is a likelihood that crest break back will occur but it is extremely unlikely that this will extend more than 50 m from the planned (current) crest position. This conclusion is borne out by observations made at other DRC operations. There is not likely to be any effect on either infrastructure or adjacent stakeholders should this occur. This report recommended that a continuous programme of additional site investigation, face mapping material sampling, testing and monitoring is implemented to improve confidence in the slope designs.

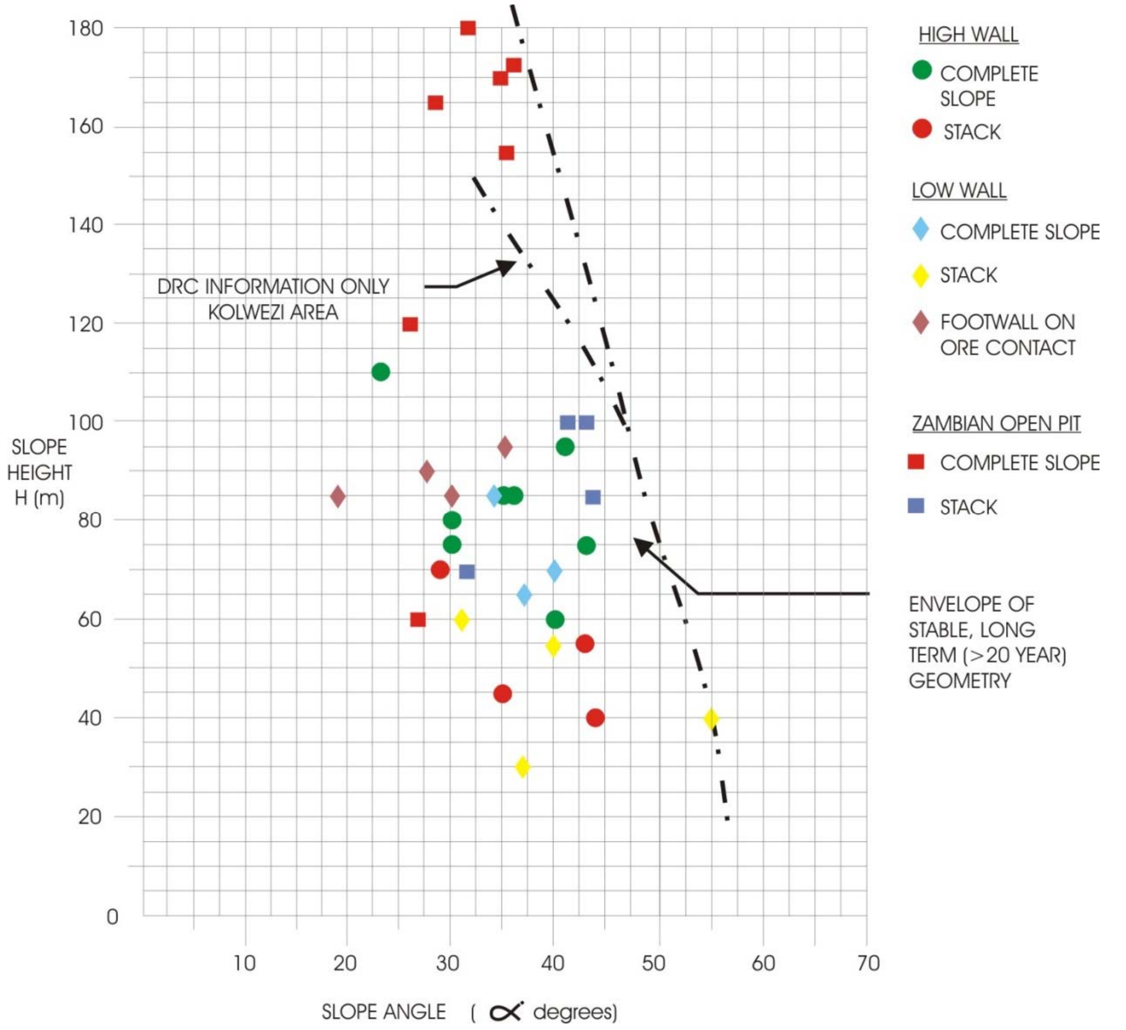


srk consulting	**Metorex** Ruashi - Layout of OHMS geotechnical investigation holes (2011)	Project No. 453459

Figure 3.18: Ruashi – Layout of OHMS geotechnical investigation holes (2011)

An analysis carried out by SRK has generated a relationship between slope height and overall slope angle for a selection of DRC and Zambian Copperbelt open pit operations. An optimal frontier was defined within which no significant failures were observed. For reference, this is included as Figure 3.19. Both the OHMS recommendations and the preferred Ruashi overall slope designs lie within this optimal frontier. Although an opportunity for increasing the overall slope angle appears to exist, the occurrence of highly talcose RAT within a significant thickness of saprolitic material may mitigate against this.

Conditions prevailing on the southern face at the planned mining limit were inspected during October 2012 and found to be very good. The Ruashi south pit footwall slope would plot at H=175m and α=29° in Figure 3.19. These conditions are illustrated in Figure 3.20. It is noted however that this face has been excavated largely during the winter months of 2012 and has not yet been exposed to erosion and water pressure effects occurring during the summer months. The light colouration of the faces indicates that there is a considerable amount of talcose material within the slope.



srk consulting	**Metorex** Ruashi – Data base of stable slope geometry – DRC and Zambian Copperbelt open pit operations	Project No. 453459

Figure 3.19 Ruashi – Data base of stable slope geometry – DRC and Zambian Copperbelt open pit operations

srk consulting	**Metorex** Ruashi – View of the south face (October 2012) showing the final slope excavated in highly talcose material	Project No. 453459

Figure 3.20 Ruashi – View of the south face (October 2012) showing the final slope excavated in highly talcose material

3.7.2 Risk issues and their mitigation

[SR6C]

Data Quality

- **Saprolitic RAT**

  Data from the OHMS report indicate that, with the exception of the Chok saprolite, the properties of saprolites are very similar in both Pit II and Pit III. Statistically, all RAT saprolites can be considered to belong to a single group.

  There is a concern however that the overall core recovery achieved in saprolites is only in the range 55% to 63%. It is probable that much of the weaker material, particularly talc, which will have a major influence on stability, has not been recovered. This implies that there is a very strong bias in the test results towards stronger material.

  There exist a number of strength parameter anomalies in laboratory results presented by OHMS. Despite compliance with standard practice when sampling and testing, it appears that a range of strength values from peak to residual has been recorded. Multi stage shear box testing which is considered acceptable for soil and rock but not for saprolites may have contributed to anomalies.

  In SRK's opinion however, the quality of laboratory data, together with data based on back analysis of existing slopes, provides acceptable geotechnical parameters for design.

  To improve confidence in the analysis and to identify possible anomalous areas within the slopes, there remains the necessity to collect good quality information on the nature and distribution of the saprolitic materials which form the upper portion of the slopes. This can be achieved with a combination of geotechnical drilling and face mapping.

  The advantage of face mapping over geotechnical drilling is that more extensive areas can be inspected and samples can be selected to provide appropriate information for different saprolite domains that may be identified. In particular, talc zones can be identified, mapped and sampled.

  During discussions with the MRM Department during the site visit, it was suggested that the proposed trial of the PIMA (portable infra-red mineral analysis) technique could be extended to include development of a geotechnical data base related to mineral (talc) content.

- **Fresh RAT**

  A total of 56 samples were collected and tested by OHMS during the 2011 study. Of these, 41 were considered to be sufficiently reliable to include in a data base which is summarised in Table 3.11.

Table 3.11: Ruashi Mine – Summary of slope design recommendations

Material	Shear Strength Properties			
	Friction angle (Φ°)	Standard Deviation	Cohesive strength (c, kPa)	Standard Deviation
Transitional RAT	36.4	3.7	1 020	220
Fresh RAT	39.3	3.5	1 250	270

In SRK's opinion, this range of properties is consistent with a fresh siltstone or fine grained sandstone and is likely to provide a reasonable estimate for fresh RAT.

It is noted that, as far as SRK is aware, no testing of CMN material forming the northern slopes has been carried out.

Monitoring of Groundwater Conditions

The stability of slopes in saprolites is very sensitive to changes in ground water pressure. Typically, suction pressure is induced in slopes as a result of excavation and acts to improve stability. With time, a slope will gradually "dry out" and the loss of suction pressure can weaken a face sufficiently to allow collapse. SRK however does not see an immediate risk of pit failure. However, it is recommended that data collection procedures, slope monitoring results and pit designs are reviewed during H2-F2013.

With respect to groundwater, the slope design in saprolite meets the minimum acceptance criteria in terms of Factor of Safety and Probability of failure provided that the pore pressure ratio does not exceed the expected value of 0.1.

To confirm the pore pressure assumptions used in slope design and to develop an understanding of the pore pressure characteristics in relation to both time and excavation rate, it is recommended that a geohydrological investigation is implemented. Due to the very low permeability of saprolitic material, conventional standpipes are not sufficiently sensitive to record pressure changes and therefore it is recommended that vibrating wire piezometers are used.

Slope Performance

An array of regularly spaced survey prisms is recommended to identify natural and anomalous deformation rates in all slopes during the active life of the mine. Decisions on placement of prisms should be made after benches have been excavated but while they remain accessible. At present, SRK is unable to provide guidelines on the number of prisms likely to be required or on their preferred location.

Proximal Infrastructure

The study carried out by SRK in 2012 concluded that break back of the southern pit crest developed in saprolitic RAT is probable but will be restricted to a maximum of 50 m and will not impact on infrastructure beyond the pit boundary.

However, as similar saprolitic materials form the upper portion of other slopes on the mine, it can be reasonably assumed that break back of these faces also will occur. Already, examples are evident in the west face of Pit I below Dump D and in the north slope of Pit 3 adjacent to the haul road. It is recommended that additional studies are conducted to assess the risks presented to proximal infrastructure during the planned mine life.

Future mining (underground)

Although not included in the scope of this review, SRK understands that future underground mining to extract sulphide ore remains a possibility. Cut and fill mining would be appropriate for the more steeply dipping parts of the orebody while sub-level caving could be operated in wide and flat portions. Should underground mining be implemented, it is recommended that a thorough mining rock engineering analysis is carried out to identify any deformation that may be induced in the overlying slopes, particularly the south slope. Should movements be sufficient to cause instability of the upper slope in saprolite, preventative measures must be identified and implemented to guarantee stability of the slope in perpetuity should this be warranted by the risk to proximal operations or infrastructure.

3.8 Hydrogeology and Hydrology

The comments which follow are based on a review of a CPR compiled by Metorex in 2010 and additional hydrogeological data collected since that report. This review aims to identify the most significant risks to ground and surface water, given the available data. No site visit was conducted as part of the hydrogeological review.

3.8.1 Baseline description

Surface Water

The Ruashi Mine is situated in the upper reaches of the Lualaba River. The Ruashi River, in which much of the mine infrastructure is located, flows via the Luano River into the Lualaba River. A tributary, the Kebumba River, drains the tailings dam area towards the NE. The Mine is located to the north of the water divide at approximate elevation of 1 285 m amsl. Surface water drainage is therefore expected to be north-northeast.

- **Storm water control** – control measures incorporating diversion of clean water away from the open pits, plant and tailings dam, and storm water capture from different disturbed areas of the mine site and return to the process plant were planned. A storm water dam was constructed and temporary pumping system to transport the storm water to the process plant was installed in 2010. Installation and commissioning of a permanent pumping system was due to be completed during the dry season of 2010. This work has been completed and storm water management receives attention as necessary.

Groundwater

- **Hydrogeological Units** – The hydrostratigraphic units as documented by KLM Consulting Services (Pty) Ltd ("**KLMCS**") in 2011 for the Ruashi Mine are summarised in Table 3.12. Drilling of abstraction (dewatering) and monitoring drill holes by KLMCS focused on these hydrogeological units.

Table 3.12: Hydrostratigraphic units at Ruashi Mine (KLMCS, 2011)

Hydrostratigraphic Unit	Lithology	Thick (m)	Model Layer	K	S	Comments
1. Laterite	Clay	20		0.1	0.0001	Limited thickness and low groundwater potential, estimated yield <20m^3/hr
2. Kundulungu	Clay, sandy clay	100-200	1	0.1	-	Yield <5m^3/hr (drill estimate)
3. CMN	Highly weathered and fractured fresh siltstones, conglomerates, limestones, quartzite	100	2	0.1-0.5	0.02	Yield 10-100m^3/hr, from test pumping and monitoring drill holes.
4. ROAN Ore body	Highly weathered and highly fractured dolomites, dolomitic sandstones of Roan Supergroup and forimg the ore body	100	3	2-7	Sy-0.02 S-0.0004	Comprised of BOMZ, SDS, SDB, DSTRAT, RSF, RSC and MV sub-units. Essential to identify sub-units from drilling and respective hydraulic parameters from pump testing. Yields as high as 400m^3/hr.
5. RAT1		100	4	<0.1		Semi-impermeable to impermeable. Yield enhanced in breccias.
6. RAT2		-	5	<0.1		Semi-impermeable to impermeable. Yield enhanced in breccias.
7. BRECCIA		Varied	-	-		Significant to groundwater occurrence.

- **Groundwater Use** – Water is abstracted for domestic use from the village water supply drill hole and from the Pit I area.
- **Groundwater levels and flow directions** - A water level contour map was produced by KLMCS based on monitoring data for June/July 2011 from 41 monitoring drill holes. The results showed a regional SW-NE groundwater flow from the water divide south of the mine. Reversed groundwater flow was observed within the vicinity of the pits, attributed to mining and mine dewatering in pits 1, 2 and 3, resulting in flow towards the pits. A radiating groundwater flow from the Tailings Storage Facility ("**TSF**") was attributed due to elevated groundwater levels as a result of infiltration of mine residue water from the TSF.
- **Recharge** - No detailed study on groundwater recharge rates was available for the Ruashi Mine. KLMCS assumed recharge rates of 20% of mean annual rainfall ("**MAR**"). Given a MAR of 1 200 mm/yr, a groundwater recharge rate of 240 mm/yr was assumed for the area.
- **Water use and supply** - Water to the Ruashi Mine is supplied from groundwater, from both the open pit and drill holes. This water is delivered to the process water dam, before being used in the plant at 6 500 m^3 of water per day. Service water for the process plant is available from one dedicated drill hole supplying potable water to the offices, workshops and service water tank.
- **Groundwater monitoring** – KLMCS reported that groundwater quality monitoring had taken place since 2007. The work done by KLCMS resulted in the establishment of a groundwater monitoring network and a conceptual numerical hydrogeological model.

Water Quality

- **Surface water** - there is correlation of high EC, Cl and Cu/Co concentration episodes in the Luano and Kebumba rivers with values observed from the stormwater dam, TSF and return water dam ("**RWD**") (May-July 2010 and October to November 2010). Effluent discharge from the stormwater dam and TSF/RWD, occasionally discharges direct into the river system, either as direct surface flow or seepage. Residence time for the groundwater system from groundwater recharge to discharge as baseflow is short and this is proven by immediate water level rises and decline during the rainfall season and dry season respectively (KLMCS, 2011).

  Metorex informed SRK that the water quality in the Luano and Kebumba rivers is influenced not only by the Ruashi Mine, but also by the neighbouring Chemaf mine and the Ruashi Commune, where there is no formal sewage or waste disposal system.
- **Groundwater** - The need for a surface water and groundwater quality assessment arose after low pH values were recorded from drill holes drilled in 2006-2007 around the TSF (KLMCS, 2011).

Following the drilling programme by KLMCS in 2011, seventeen groundwater samples were taken and analysed for a full suite of hydrochemical parameters, including heavy metals. The samples were taken from dewatering drill holes within the pits, monitoring drill holes outside the pits and the tailings dam sites (GCM and Ruashi tailings dams). KLMCS' conclusions from the laboratory results are summarised in Table 3.13.

Table 3.13: Summary of Laboratory Results from groundwater sampling at Ruashi Mine (KLMCS, 2011)

Parameter	Typical Values	Extreme Values	Comments
pH	7 to 9	6.6 (GWD5)	
EC	140 to 280 mS/cm	320 to 430 mS/cm (GWD5 and MH2-2)	Groundwater contamination
Na	3 to 19 mg/l	61.1 mg/l (GWD5)	
SO4	<40 mg/l	114 mg/l (MH2-2)	Not representative of background values
Cl	Low – 4 mg/l	19 mg/l (GWD5)	Almost 5 times background, indicating groundwater pollution
HCO_3	60 to 160 mg/l Average 120 mg/l		
Ca	45 mg/l		
Mg	35 mg/l		

Groundwater pollution is indicated from the concentrations of EC, pH, Na and Cl. The highest concentrations of EC, pH, Na, Cl, Cu and Co occur in groundwater during summer or the rainy season (November-March). The concentrations decrease during the dry season (April-October) and the trend is considered cyclic due to recharge and evaporation. Further groundwater and surface water monitoring was done in 2012 and 2013. The groundwater results (no units were provided) indicate the following:

- Cu: most of the monitoring results returned values below 1.6 with the exception of three boreholes, namely "BH 2" (1.6, 6 Feb 2013), "BH 5" (1.8, 1 Nov 2012) and "Tailings Dam 1" (2.6, 3 Jan 2013). The average was 0.1 ppm (assumed) over the period monitored;
- Co: values ranged from 0 - 52.5 with the average being 7;
- EC (conductivity): values ranged from 1.1 - 11 050 with the average 2 223;
- pH: values ranged from 3.9 - 8.8 with an average of 6.6; and
- Na: values ranged from 0 - 1279 with an average of 275.

SRK was unable to verify the correctness of these data against the original laboratory results.

Water quality data for May 2012 to May 2013 indicates that the low pH readings are still being obtained in the Fish Dam. A once-off historic pollution event resulted in low pH readings in the TSF monitoring boreholes and a similar pH in the Fish Dam. Metorex drilled new scavenger boreholes between the TSF and Fish Dam whereby the low pH water plume is collected and pumped back to the TSF. The efficacy of the scavenger boreholes needs to be evaluated.

3.8.2 Numerical Groundwater Model

A numerical model was developed by KLMCS in 2011. The steady state groundwater model was calibrated using observed water levels taken in January 2010 and abstraction volumes from daily pumping records to simulate groundwater flow gradients, directions and abstraction rates from the mine dewatering drill holes and sumps, the plant water drill holes and the camp drill holes. Thirty four (34) observation drill holes were used as control data to calibrate the model.

Long-term water level monitoring graphs show rising water levels during the wet season (October/November – March) due to rainfall recharge and falling water levels in the dry season when there is no recharge. Groundwater level rises are shown in the pits during the wet season despite pumping, indicating recharge inflow is higher than abstraction rates and increased pumping is required.

A similar water level trend is also shown by environmental monitoring drill holes at the tailings dam, indicating groundwater recharge is higher than infiltration rates from the plant discharge.

The general observed long-term trend is declining water levels since 2010 due to dewatering from the pits, with an average decline rate of approximately 8 m/y. However, during the rainy season, recovery of water levels is experienced and water levels recover by 2 m, giving an overall decline rate of 6 m/y. Water levels in pit 1 have since decreased by 13 m since July 2011 after a new dewatering drill hole BH1-15 was connected.

3.8.3 Legal Framework

An Environmental Adjustment Plan ("**EAP**"), compiled jointly by Africa Mining Consultants (Kitwe, Zambia) ("**AMC**") and Bureau d"Etudes Environmentales et Minieres du Congo ("**BEMC**") in March 2005, was approved by the Ministry of Mines. The EAP was amended by BEMC in September 2007 to include Phase II of the Ruashi project and authorised by the Ministry of Mines.

The authorisation for the "Exploitation of Water Resources", as well as a permit for the discharge of water from the pit into the Luano River, was valid until the end of January 2010. Water is not discharged directly into the Luano River. A series of dewatering boreholes reduces the ingress of water in to the pit. The water that is present in the pit from seepage and rainfall is pumped to the coffer dam and not directly into the river. SRK therefore understands that the current situation is that no permit is currently required for discharge of water from the pit into the Luano River. Water from the coffer dam is used in the plant. In the case of high rainfall events water may spill over the dam into the wetland preceding the river. There is no provision in DRC law for a permit for water discharge – all environmental law pertaining to mining is in the Mining Code, which does not make provision for water discharge permits. Legal issues in this respect do not relate to permitting although periodic pollution events may have legal implications. SRK has been advised by Metorex that currently there is no historical pollution events that have legal implications.

3.8.4 Hydrogeological and Hydrological Risks

Risks to Surface and Groundwater

KLMCS conducted drilling and water sampling in 2011 and identified groundwater contamination as a risk. Based on limited data and at most 1 year monitoring, KLMCS concluded the following:

- Groundwater pollution is taking place from the tailings dam;
- Under current (2011) conditions the groundwater and surface water environment is under moderate risk of adverse pollution;
- Solute transport modelling (KLMCS, 2011) predicts an increase in concentration of pollutants in groundwater with peak concentrations achieved in 10 years (from 2011);
- The model further predicts that mine dewatering will increasingly reverse groundwater flow direction, resulting in migrating of pollutants from the tailings dam;
- Post mine closure predictive modelling indicates that the groundwater system will not recover to pre-mining background water quality. The model was run for 15 years beyond the planned LoM. This prediction implies the low pH conditions at the tailings dam will require treatment as the system will not recover naturally.

KLMCS further concluded from the monitoring data that pollutant concentrations have increased by 3 to 10 times from the background concentrations measured away from the TSF. There is a plume of low pH water seeping from the tailings dam due to the discharge of low pH tailings at the time the plant was started, and the lime plant had not been commissioned. The extent of the plume is currently unknown and the time it will take to remediate has not been determined. The pH of tailings has subsequently been stabilised, but measurements of low pH are still detected in the monitoring drill holes around the tailings dam. The pH is measured in the TSF, return water dams and monitoring drill holes on a daily basis. A pumping system whereby low pH water is pumped out of the drill holes and discharged into the return water dams has been initiated. The effectiveness of this measure will be tested through the daily monitoring.

Despite describing some of the parameters tested as "exceptionally high", KLMCS finally concluded that all values, except around the TSF, are within World Health Organisation ("**WHO**") limits for drinking water and not a hazard to the environment.

Ruashi Mining confirmed it had drilled a fence of drill holes around the TSF, which, as reported in the May 2013 monthly report has been expanded with additional holes to prevent the water from entering the surface water system. The drill holes are equipped with pumps to pump the low pH water back to the TSF for neutralisation with lime. This approach is intended to improve the quality of water seeping from the TSF with time, thereby potentially reducing post closure impacts on ground and surface water. However, the 2011 study by KMLCS indicated that the ground water system will not recover naturally.

Expanding Drawdown

The general observed long-term trend is declining water levels since 2010, due to dewatering from the pits, with an average decline rate of approximately 6 m/y, taking into account the recovery of water levels during the rainy seasons. As far as could be ascertained from the KLMCS report, no predictions were done regarding predicted groundwater level drawdown around the Ruashi Mine (i.e. radius of cone of depression).

3.9 Mining

[SR5.4]

3.9.1 Introduction

Ruashi Mining commenced stockpile mining operations in June 2005 for processing through the Ruashi Phase I oxide flotation concentrator plant. Stockpile reserves were depleted in F2009 with open pit mining operations commencing in October 2007 to supplement feed to the Phase I process plant. The Phase II SX-EW plant construction was completed in October 2008 and was in ramp up mode for most of 2009. The mine achieved its design milling capacity of 120 ktpm in October 2009 for the first time, and since March 2010 has been operating at a monthly production rate of between 110 ktpm and 120 ktpm.

The Phase I concentrator was placed on care and maintenance in March 2009 and subsequently all copper and cobalt production has come from the Phase II plant. RoM feed has consisted of a mix of re-mined tailings (unrecovered Cu and Co from the Phase I concentrator) and direct RoM tonnes from the open pit.

On-going LoM planning is carried out as part of an annual planning cycle by an independent mining consultant using Mine2-4D and XPac Scheduler. Short term planning is carried out on-mine and monitored to ensure adherence to a strict mining sequence. LoM planning is based on a detailed 3D mine design with Gantt chart scheduling. Ruashi Mine uses GEMCOM SURPAC Version 6.1.4 for all geological / mine design software requirements and the MINESCHED module for scheduling.

3.9.2 Mining method and selectivity

The Ruashi deposit is currently mined by conventional open pit mining methods using truck and excavator combinations as illustrated in Figure 3.21.

Mining operations at the Ruashi Mine are undertaken by a local contracting company, Mining Company Katanga sprl ("**MCK**"). Short term mine design and planning, grade control and pit survey is managed by Ruashi Mining.

Maintenance of MCK's mining fleet is carried out by the Original Equipment Manufacturer ("**OEM**") under a Maintenance and Repair Contract ("**MARC**").

3.9.3 Service infrastructure

Ruashi I is largely mined out up to a depth of approximately 52 m below surface (1 240 amsl). The design extends another 28 m down to the 1 205 level. However, a southern pushback is planned to access additional ore at depth. The pit is accessed by a ramp from the north, with the north-western and south-eastern parts being serviced by ramps branching off from the existing northern ramp.

Ruashi II is the smallest of the three ore bodies. The design extends up a depth of 90 m below surface (1 195 amsl). The pit has a diameter of roughly 400 m on surface. A single ramp provides access to all the levels in both Pit II and Pit III. The current pit floor is 41 m below surface.

Ruashi III is the largest ore body with the highest overburden stripping requirement. The pit floor of phase I stripping is now at 25 m below surface and the BOMZ horizon containing HG cobalt ore is exposed in the northern portion of the pit. The pit has a designed depth of 190 m with the lowest bench on the 1 095 m elevation and is accessed by a dual ramp system. However, the poor geotechnical qualities of the weathered RAT unit on the southern pit walls preclude the presence of permanent ramps. The ramp configuration is largely a function of the separate mining stages on the southern and northern side of the pit.

The open pits at the Ruashi Mine are accessed by a 1 km haul road extending from the process plant to the Pit I access ramp.

Power is supplied at 15 kV from the Ruashi distribution sub-station with transmission via overhead conductors mounted on timber pylons. Transformers at each pit reduce the distribution voltage from 15 kV to 500 V for use by dewatering pumps in the pit.

srk consulting	**Metorex** Open pit load and haul operations in the Ruashi II pit (photo courtesy of Metorex)	Project No. 453459

Figure 3.21: Open pit load and haul operations in the Ruashi II pit

The open pits are surrounded by a 2 m high windrow to prevent the ingress of surface run-off water into the pits.

Dewatering drill holes have been drilled around the perimeter of Pits I, II and III as well as within Pit I and II to maintain the groundwater level below the mining face. Potable water from some of the drill holes is supplied to Ruashi community at a rate of 260 m^3/hr. A hydrogeological monitoring programme has been initiated to the east of Pit III to determine future pumping capacities.

As this water from the drill holes is expected to be in excess of the requirements for Ruashi community and the mine, a discharge permit was obtained to discharge in the Chemaf lease area to the east of the Ruashi mining permit.

3.9.4 Modifying factors and mining efficiencies

Previous models have applied tonnage factors to account for previous mining activities. The December 2010 model modelled voids from previous underground mining activities (physically surveyed in the pit or digitised from old working plans), and these have been incorporated into the geological model. Mining activities have largely mined through this ore.

Dilution has been accounted for by reblocking the geological model to a 5 x 5 x 5 m smallest mining unit ("**SMU**") as the primary input for the Whittle 4X optimisation. Reblocking effectively includes waste dilution in the block model at the resolution that blocks will be mined, and as a result no further dilution factor is applied.

3.9.5 Mine Design and Planning

The ultimate pit shell was prepared by VBKOM Consulting (Pty) Ltd ("**VBKOM**") using GEMCOM Whittle 4x pit optimisation software in October 2011. The ultimate pit shell selected in the pit optimisation establishes the limits of mining for purpose of defining the economically mineable resources. The parameters used in the optimisation process are set out in Table 3.14 and are reasonable for mine design purposes. The overall slope architecture set out in Table 3.15 is according to the recommendations set out in Section 3.7.

Table 3.14: Ruashi Mine - Pit Optimisation Parameters (VBKOM)

Description	Units	Value
Cu LME price	USD/t metal	8 000
Co LME price	USD/lb metal	15.00
Cobalt sales - % of LME price	%	70%
Mining cost – average	USD/t mined	3.25
Processing Cost	USD/t milled	32.33
Element processing cost - Cu	USD/t Cu in feed	200
Element processing cost - Co	USD/t Co in feed	2 430
Time Costs	USD million	56.44
Time Costs	USD/t milled	39.20
Selling cost per tonne Cu	USD/t metal	653
Selling cost per tonne Co	USD/t metal	2 220
Acid Soluble Cu/Total Cu Ratio in Oxide	%	95%
Acid Soluble Co/Total Co Ratio in Oxide	%	85%
Total metal recovery – Acid Soluble Cu	%	90%
Total metal recovery – Acid Soluble Cu	%	90%
Factor applied to Cu Co metal price to account for royalties		0.96
Mining Dilution	%	1.0%
Mining Loss	%	0.0%

Table 3.15: Ruashi Mine – overall slope architecture

Design Criteria	Sapriolite RAT	Weathered RAT	Fresh Sulphides
Batter Angle	65°	65°	80°
Bench Height	5 m	5 m	5 m
Berm Width	10 m	10 m	3.3 m
Overall slope angle	21°	28°	55°
Bench Stack	4	4	None
Catch Berm	20 m	20 m	None

The overall slope design is based on the assumption that the pit floor and slopes are kept dry.

The optimisation results for the selected scenario 1B as prepared by VBKOM are set out in Table 3.16.

Table 3.16: Ruashi Mine – optimisation results (VBKOM)

Scenario	Price Assumptions	Ore (kt)	Waste (kt)	Cu cathode (kt)	Contained Co (kt)	TCu (%)	TCo (%)	Pit #
Excluding All CMN								
1	Cu USD5 000/t, Co USD15/lb	9 765.7	57 165.9	271.0	31.1	3.27	0.47	55
2	Cu USD8 000/t, Co USD15/lb	14 143.2	96 790.1	351.8	39.1	2.94	0.41	70
3	Cu USD12 000/t, Co USD15/lb	17 273.8	109 492.3	387.6	42.1	2.66	0.36	65
Including Indicated CMN								
4	Cu USD5 000/t, Co USD15/lb	10 094.6	57 243.4	279.8	31.7	3.27	0.46	55
5	Cu USD8 000/t, Co USD15/lb	14 970.2	100 063.6	369.1	40.1	2.92	0.40	73
6	Cu USD12 000/t, Co USD15/lb	18 336.0	114 706.2	406.0	43.4	2.63	0.35	66
Including All CMN								
7	Cu USD5 000/t, Co USD15/lb	10 814.8	57 197.4	293.8	32.8	3.20	0.45	73
8	Cu USD8 000/t, Co USD15/lb	18 378.6	100 633.8	420.7	43.3	2.70	0.35	72
9	Cu USD12 000/t, Co USD15/lb	25 608.8	117 589.4	496.4	48.6	2.30	0.28	67

Mine planning which incorporates the ore and waste mining schedules that align with the plant ore feed requirements was based on the following criteria:

- Mining vertical advance rate - 3 x 5-m benches per year;
- The oxide ore classification was based on the following:
  - o Low grade – 0.9% - 1.5% TCu;
  - o Intermediate grade – 1.5% - 2.5% TCu;

- Medium grade – 2.5% - 3.5% TCu;
- High grade – above 3.5% TCu;
- BOMZ (Cobalt Ore) – TCu $<0.9\%$ and TCo $>0.2\%$.

- The plant feed profile was based on the following assumptions:
  - power constraints continue until April 2013;
  - SAG mill relining twice per year;
  - Approximate feed rate of 100 ktpm Jan to Mar and 110 ktpm for April 2013;
  - Approximate feed rate of 120 ktpm from May 2013 to end of LoM.

The optimum pit was used as a template for practical pit designs and further refined through the application of mine design criteria and other practical mining constraints. Moreover, this part of the mine planning process also requires the identification and design of defined stages or pushbacks.

The main access for the pits is via 20 m wide ramps at a gradient of 10 % to be able to accommodate 40 t articulated dump trucks ("**ADTs**"). The minimum ramp width for this size of ADT was estimated at 15 m. However, constructing the haul roads with a width of 20 m results in higher truck productivity and allows the truck fleet to be scaled up in size at a later stage.

Ore and waste mining bench height of 5 m is suitable for the mining fleet in use. The 5 m bench height in ore allows for selective mining. The stockpiling strategy relies on accurate prediction of mining grades in order to achieve consistent feed grade into the plant. It is therefore important to have an effective grade control management programme and on-going resource definition drilling.

The final mine layout is presented in Figure 3.22. Three distinct pits (Ruashi I, II and III) can be distinguished which relate to the Ruashi ore bodies. However, the close proximity of the Ruashi II and III ore bodies results in the associated pits connecting at 60 m ("**mBs**").

3.9.6 Development and Production Schedule

A revised Ruashi Mine LoM plan and scheduled reserve for F2013 was completed in December 2012 by Tomahee (Pty) Limited ("**Tomahee**") using Mine2-4D and XPac mine planning software and provides the basis for the 30 June 2013 Ruashi Mine Mineral Reserve. Previous schedules prepared by VBKOM showed a fluctuating amount of finished metal by time period. The Tomahee schedule used the philosophy of Mine to Stockpile to Mill which improved the LoM results compared to the direct Mine to Mill practice. Ruashi Mining lowered the waste and ore mining volumes in the early years of the schedule so as to reduce the size of the ore stockpile and the quantum of working capital tied up in the stockpiled ore.

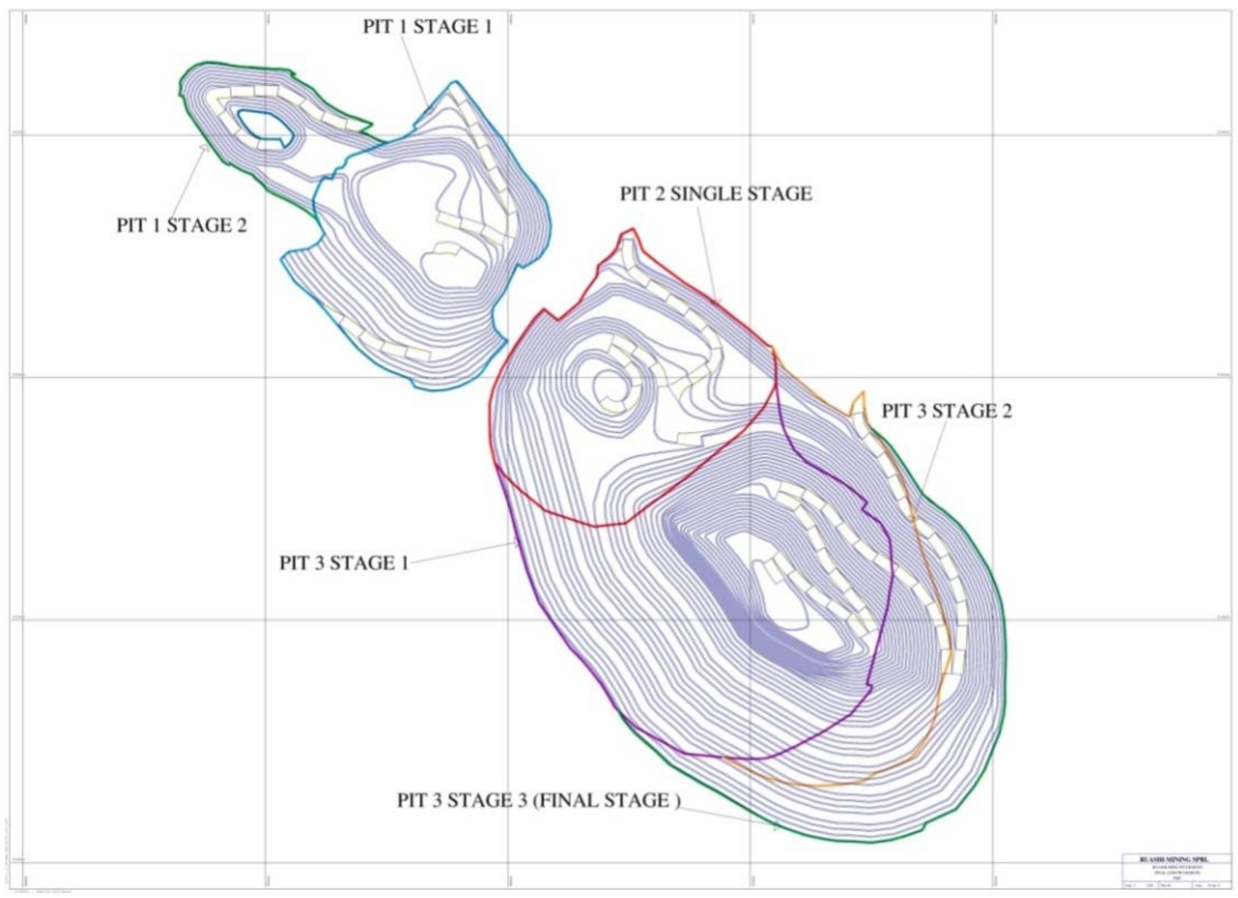
The LoM schedule is based on an accelerated waste mining strategy in order to expose high volumes of ore. The ore is classified into various grades in order to facilitate blending of ore to the plant to achieve a consistent copper and cobalt production profile.

Ruashi Mine currently has a life of approximately 10 years based on copper and cobalt oxide ore. The majority of this ore can be mined without drilling and blasting. Mining of ore is completed in 8 years, but the stockpiled material allows the plant to be fed for a further 2 years, hence the 10 year mine life. Sulphide ores exist at lower elevations which could extend the life of the operation if studies show this ore can be economically mined and processed.

Due to limited space the mining schedule incorporated investigations into waste dump and stockpile designs. Some of the areas identified for future dumping have infrastructure that would have to be relocated for dumping to occur. A study has been prepared for the back-filling of Pit I after the oxides of this pit have been mined out. It is scheduled that dumping of waste into Pit I will begin in 2019.

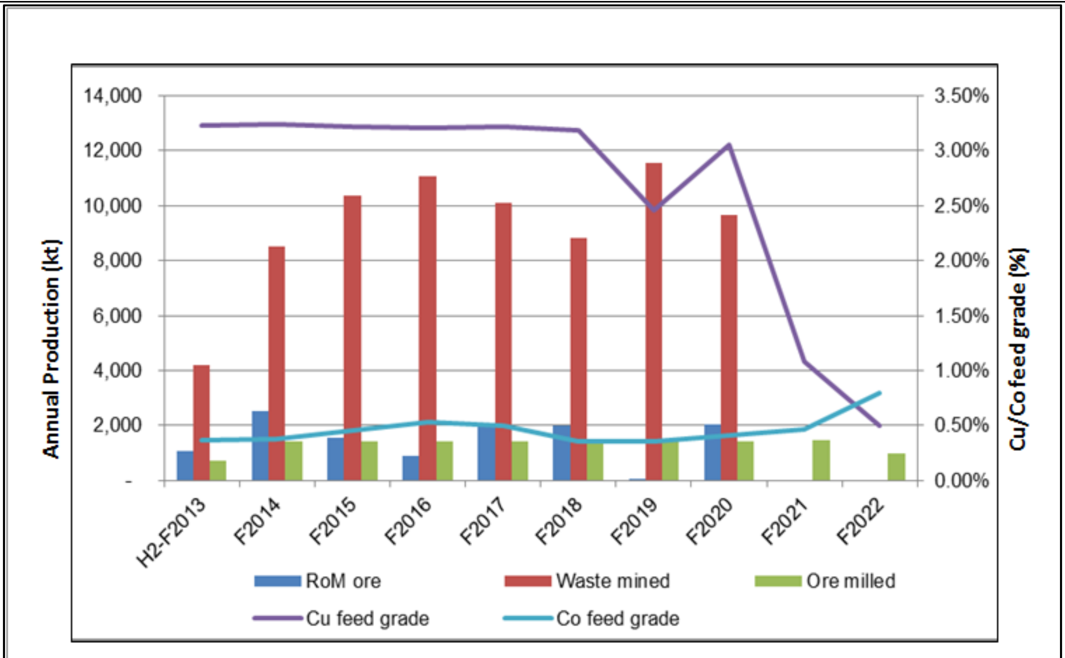
Designated areas for the stockpiling of the various ore grades have been identified and quantified.

Figure 3.23 shows graphically the LoM production schedule for the Ruashi Mine.



srk consulting | **Metorex** Ruashi Mine - Plan View of Mine Layout with Surface Footprint of Planned Stages | Project No. 453459

Figure 3.22: Ruashi Mine - Plan View of Mine Layout with Surface Footprint of Planned Stages



srk consulting | **Metorex** Ruashi Mine – LoM mining schedule | Project No. 453459

Figure 3.23: Ruashi Mine – LoM mining schedule

The production schedule in Figure 3.23 is drawn from Measured Mineral Resources and Indicated Mineral Resources and available surface stockpiles and tailings material. It should be noted that the original LoM plan for the Ruashi Mine included some 2.2 Mt of Inferred Resources, which would be mined in the normal sequence of operations. If these Inferred Resources were to be included, the LoM for Ruashi would be extended by almost two years.

3.9.7 Mining Operation

Grade control and pit survey is managed by Ruashi Mining. Ruashi derives its revenues from both copper and cobalt. The Ruashi Mine LoM plan is based on the assumption that a block of material should be processed if the income derived from the sale of the product covers the cost of processing the material. The marginal cut-off grade is therefore the grade of the material where the income from the sale of the product is equal or more than the processing cost.

3.9.8 Mining Equipment

The mining equipment is owned and maintained by MCK, the mining contractor. The majority of material can be loaded without drilling and blasting. Loading is carried out by diesel powered hydraulic excavators. Waste and ore is hauled by 40 t ADTs.

The current MCK Mining Fleet consists of the following:

- Hydraulic Excavators – 2.5 to 6.5 m^3 buckets 8;
- 40 t ADTs 28;
- Track Dozers 4;
- Graders 4.

To improve mining operational efficiency, a new equipment maintenance workshop has been constructed. In addition, the mine is planning to implement a fleet management system to ease and improve tracking of key fleet performance and maintenance metrics and management of material mined from the pits and stockpiles.

The current utilization of mining equipment is less than the target of 80%. In order to meet the current LoM plan, this utilization will require significant improvement in order to achieve the targets. It has been recommended that the Ruashi Mine works closely with the mining contractor so that the targets will be achieved.

3.9.9 Manpower

The Ruashi Mine manpower complement associated with mining activities consists of management and supervision to direct and control the activities of MCK. Further, grade control officers working in the pit and various stockpiles fall under the responsibility of the mining department. The total complement is approximately 120 people.

3.9.10 Capital and Operating Expenditure

Ruashi Mining has provided for mining capital expenditure during H2-F2013 and F2014 as set out in Table 3.17. Given the importance of tracking material flows and grade control for the mine to stockpile to mill strategy, the Ruashi Mine should implement a sophisticated truck dispatch / material tracking system in order to manage the mining, stockpiling and blending of ore. SRK estimates that the cost of such a system will be around USD1.0 million and has added this into the capital for F2014.

Table 3.17: Ruashi Mine – Mining Capital Expenditure – H2-F2013 and F2014

Mining Capex		H2- F2013	F2014
New capital			
Waste stripping - Pit III	(USDm)	7.66	0.00
Drilling	(USDm)	0.50	2.00
Dewatering	(USDm)	0.25	0.74
Radar - wall monitoring	(USDm)	0.50	0.65
Other	(USDm)	0.67	2.14
SRK added:			
Truck dispatch / material tracking system			1.00
Total	**(USDm)**	**9.78**	**6.53**

The mining costs for ore and waste at the Ruashi Mine for H2-F2013 to F2018 are set out in Table 3.18. The unit costs are based on actual costs experienced by the Ruashi Mine during F2012 and H1-F2013, a detailed review by Metorex of major cost drivers at the time of developing the budget for F2013 and the terms of the mining contract with MCK. The average cost for ore and waste is a weighted average based on the percentage of ore and waste to be mined from each pit.

Table 3.18: Ruashi Mine – mining costs – H2-F2013 to F2018

Item	Units	H2-F2013	F2014	F2015	F2016	F2017	F2018
Mining - ore	(USDm)	2.85	6.78	4.22	2.38	5.00	5.14
Mining - waste	(USDm)	3.46	21.63	25.09	25.12	21.63	18.89
Mining - other	(USDm)	5.97	11.47	11.47	11.47	11.47	11.47
Ore rehandling costs	(USDm)	1.41	2.82	2.87	2.83	2.83	2.83
Total Mining	**(USDm)**	13.69	**42.70**	**43.65**	**41.80**	**40.93**	**38.32**

Ruashi Mining plans to implement various management initiatives during the second half of F2016 and expects to realise a saving in the unit mining rates as set out in Table 3.18. SRK is satisfied that these initiatives can be reasonably implemented.

Ruashi Mining has assumed for budgeting purposes that all ore fed to the plant will be reclaimed from the ore stockpiles, at a rehandling cost of USD2.00/t.

3.9.11 Sulphide Project

A pre-feasibility study for the sulphide ore bodies below Ruashi I and III open pits was prepared by Sound Mining Solution (Pty) Ltd ("**SMS**") for Metorex in January 2012. The project is sub-economic due to high off-mine costs.

In the report, SMS recommended the following:

- Complete open pit mining of oxides from Pit I;
- Back-fill Pit I with waste from Pit III;
- Carry out exploration programme for Ruashi III underground;
- Carry out in-fill exploration programme for Ruashi I underground.

The financial model in Table 4.25 excludes any production from the sulphide project. This could be considered as upside potential, notwithstanding that some changes to the process plant would be required.

3.9.12 SRK Comments

Mining Operations

The current oxide mining operations are based on a conventional truck and shovel open pit mining method. The majority of the material can be loaded without drilling and blasting. The mining is carried out by the local mining contractor MCK under the supervision of Metorex personnel.

The updated mining schedule has been based on a mine to stockpile to mill strategy in order to blend and thereby minimise the variability of finished metal by time period. To ensure that this is carried out efficiently it is imperative that the following be implemented:

- A short term evaluation drilling programme so that ore grades and rock-types can be more accurately identified for the blending process. Metorex confirmed that grade control drilling had been limited during F2012 to preserve cash during low power availability, but plans to commence using a 15 m x 15 m drill grid in H2-F2013;
- A truck dispatch / material tracking system be purchased and commissioned within the next year in order to manage the mining, stockpiling and blending of ore. Metorex had been considering such a system, but could not progress it due to cash limitations. Ruashi Mining commenced with a SQL based database to collect tally sheet monitoring information on a shift basis, which will be reconciled against survey measure data.

Waste Dumping

Generally there is limited space for the dumping of waste material. The latest mining schedule has taken this into account and has identified the need to mine out Pit I oxide ore before F2019 so that waste from Pit III can be backfilled in this mined out area. It has also been identified that the backfilling should take place in a set sequence so as not to interfere with the possible access to and underground mining of the Pit I sulphide ore body. Providing the mine plan is followed, there should not be any problem regarding dumping of waste.

Metorex confirmed that the waste dumping strategy is well understood by mine management and backfilling of Pit I will commence as scheduled. A backfill design and implantation plan will be established for the Ruashi Mine waste dump in Pit I as part of the F2014 LoM plan. This will be elevated to the Ruashi risk register and work costed in the F2014 budget.

3.9.13 Risks and Opportunities

The following risks and opportunities have been identified which may impact on the project:

- The limited space for waste material requires that Metorex's waste dumping strategy is carefully managed. Metorex believes that three lifts adequately cater for waste to be dumped from Pit III to the end of 2018 and the in-pit dumping in Pit I will adequately cater beyond 2018;
- The successful blending of ore to the mill is dependent on effective grade control procedures and implementation of a sophisticated truck dispatch / material tracking system. Inefficiencies in such systems are a concern and could negatively influence profitability. Metorex has indicated that grade control procedures are in place for the pit to stockpile to mill mining strategy and a continuous improvement process has been embarked upon to ensure the effectiveness of the system. Capital has been provided for the purchase of a truck monitoring and dispatch system which will assist with the stockpiling strategy;
- The availability (or lack) of skilled personnel required to implement and operate sophisticated procedures is of concern. Metorex mentioned that a training programme is being embarked upon to address any skills shortfalls within the mining and mineral resource management departments at the Ruashi Mine;
- Ruashi Mine has the opportunity of extending the LoM by converting Inferred Mineral Resources into Indicated or Measured Mineral Resources. This will entail close spaced drilling of the CMN unit in Ruashi I and Ruashi II;
- The sulphide Inferred Mineral Resources need to be converted to a Mineral Reserve through completion of a feasibility study to determine the viability of mining underground and processing the RoM sulphide ore.

3.10 Mineral Processing

3.10.1 Metallurgical Testwork

The pertinent test work for the CPVR relates to hydrometallurgical test work for the Phase II plant at both laboratory and pilot scale level conducted by Mintek in South Africa. The various stages of test work evaluated the following:

- Ore characterisation by means of head grade analysis and determination of the gangue acid consumption **("GAC")**. The GAC results were used to compile a composite sample representative of RoM feed;
- Optimum feed conditions;
- Conditions for leach, solid-liquid separation and washing of leach residues, low grade and HG SX, Cu EW and Co purification and precipitation;
- Mineralogical investigation of leach residue with respect to Cu and Co leach efficiencies;
- Comminution tests comprising JKTech drop weight tests, Bond ball mill work index, Bond rod mill work index and Bond crushability (impact) work index.

The predicted Cu and Co recoveries from the Mintek test results are shown in Table 3.19.

Table 3.19: Ruashi – Mintek Test Work Results

Item	Units	Test Work Results
Cu head grade	(%)	3.87%
Co head grade	(%)	0.62%
Cu recovery	(%)	85%
Co recovery	(%)	70%

Cobalt recovery in the leach section is dependent upon achieving a reducing environment, obtained by the introduction of SO_2 gas. Due to an irregular supply of SO_2 gas from the acid plant, the SO_2 has been generated through the intermittent addition of SMBS, resulting in an unstable leaching environment, and in reduced cobalt recoveries.

3.10.2 Process Description

The simplified process plant flow sheet for the Ruashi Mine is described in the following section and shown in Figure 3.24. An isometric view of the plant is shown in Figure 3.25.

Reduction Plant (Crushing and Milling)

The primary crusher consists of a ramp for tipping of RoM ores, vibrating grizzly, a feed-bin, a jaw crusher and feeders for discharging material. Material from the primary crusher is discharged onto a stockpile. It is removed from the stockpile via 4 apron feeders and 2 conveyors located in a tunnel which then feeds the mill feed belt conveyor. The standby crushing plant which primarily serves as a back-up function, discharges directly to the mill feed belt conveyor.

The mill feed belt conveyor delivers the crushed ore to the Semi Autogeneous Grind ("**SAG**") mill. Water is added to the mill. The milled ore then gravitates to the mill discharge sump. From the sump the mix is pumped to a bank of four cyclones (of which one is currently a stand by unit). The cyclone overflow from the mill circuit reports to the Pre-Leach-Thickener.

The power rating of the SAG mill is 1.2 MW and the 5 secondary ball mills each has a rating of 250 kW. Only three of these mills are in operation at any time with two mills as spare. The milling circuit capacity is 220 tph. The average grind is reported to be 65% -75 µm.

Figure 3.26 shows the milling circuit configuration of the SAG mill in combination with five ball mills.

Copper and Cobalt Pre- Leach

The cyclone overflow from the milling process slurry with a density of 1.25 to 1.30 t/m^3 reports to the Pre-Leach Thickener. In the Pre-Leach Thickener the increase in density is achieved through the mechanical action of solid liquid separation and the addition of a flocculent. The thickener underflow with a density of 1.5 to 1.6 reports to Pre-Leach Storage Tanks. The overflow reports to the mill sump / process water pond.

The name plate capacity rating of this section is 175 tph.

Copper Plant

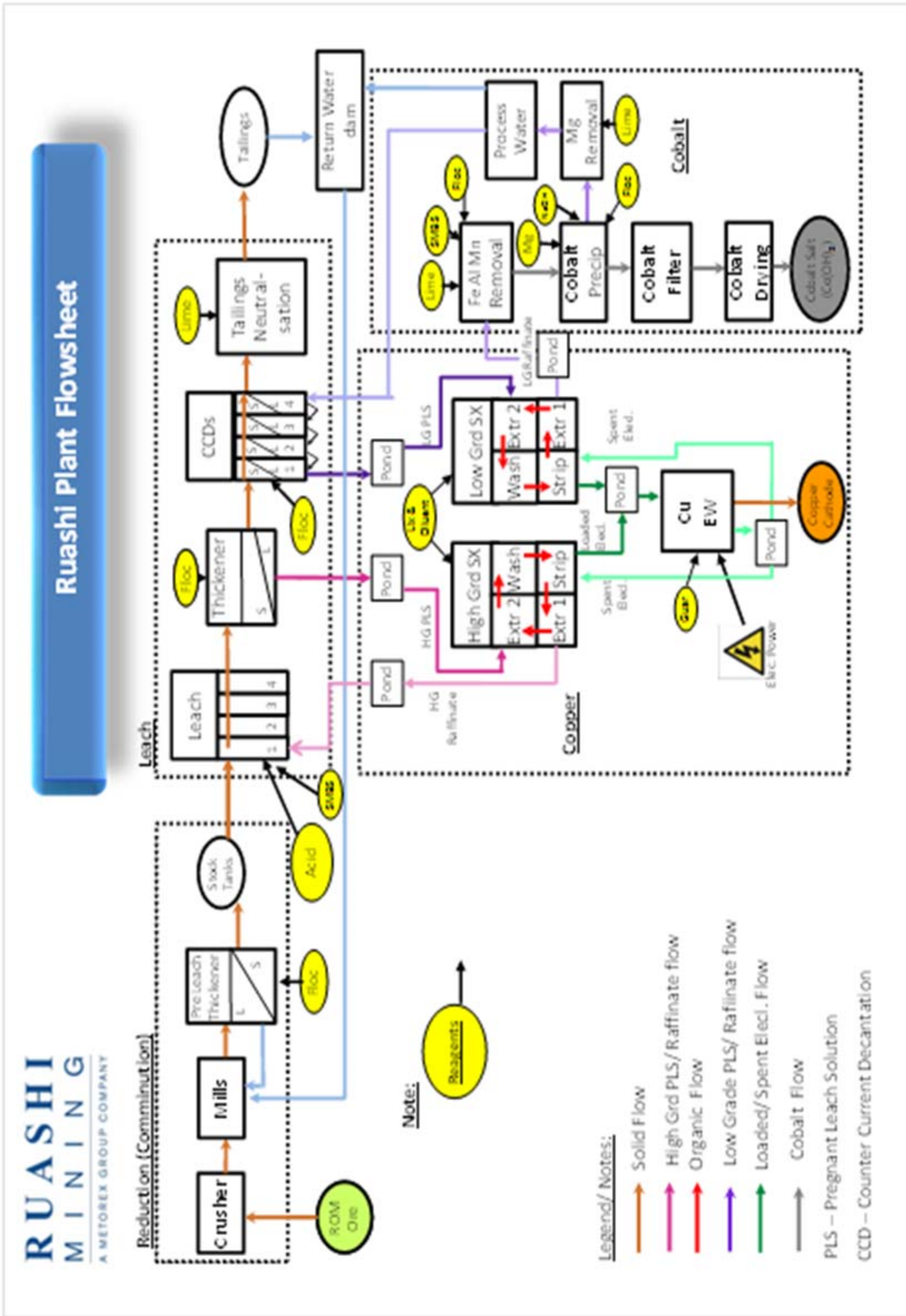
The Copper Plant consists of the following sub-sections: Leaching (copper and cobalt), CCD, Tailings Neutralization, Copper SX and Copper EW.

- **Copper and Cobalt Leach**

  The Leach circuit is the first step in the refining process of copper. The aim of Copper Leaching is to leach copper and cobalt metal from the feed ore with minimal dissolution of other impurities. Sulphuric acid is used to achieve copper and cobalt dissolution.

  Leaching is performed in four leach tanks arranged in series (6 hours total residence time) under acidic and reducing conditions. The optimum acidity and oxidation/reduction potential conditions in the leach tanks are maintained by the addition of sulphuric acid (to all four leach reactors) and sulphur dioxide gas (as sulphur burner gas, to the last two reactor only) respectively.

  Milled ore in the form of slurry is received by the leach stock tanks from the reduction circuit. These tanks serve to hold the ore to prevent large fluctuations of feed into the leach tanks. The slurry is pumped from these tanks to the first of four agitated leach tanks. Here the slurry is mixed with sulphur dioxide ("**SO_2**") or Sodium meta bi-sulphate ("**SMBS**") solution and acidified raffinate. Sulphuric acid dissolves the copper and cobalt, removing the metals from the solid ore and creating a leach solution. The SMBS is used as an alternative to SO_2 gas.



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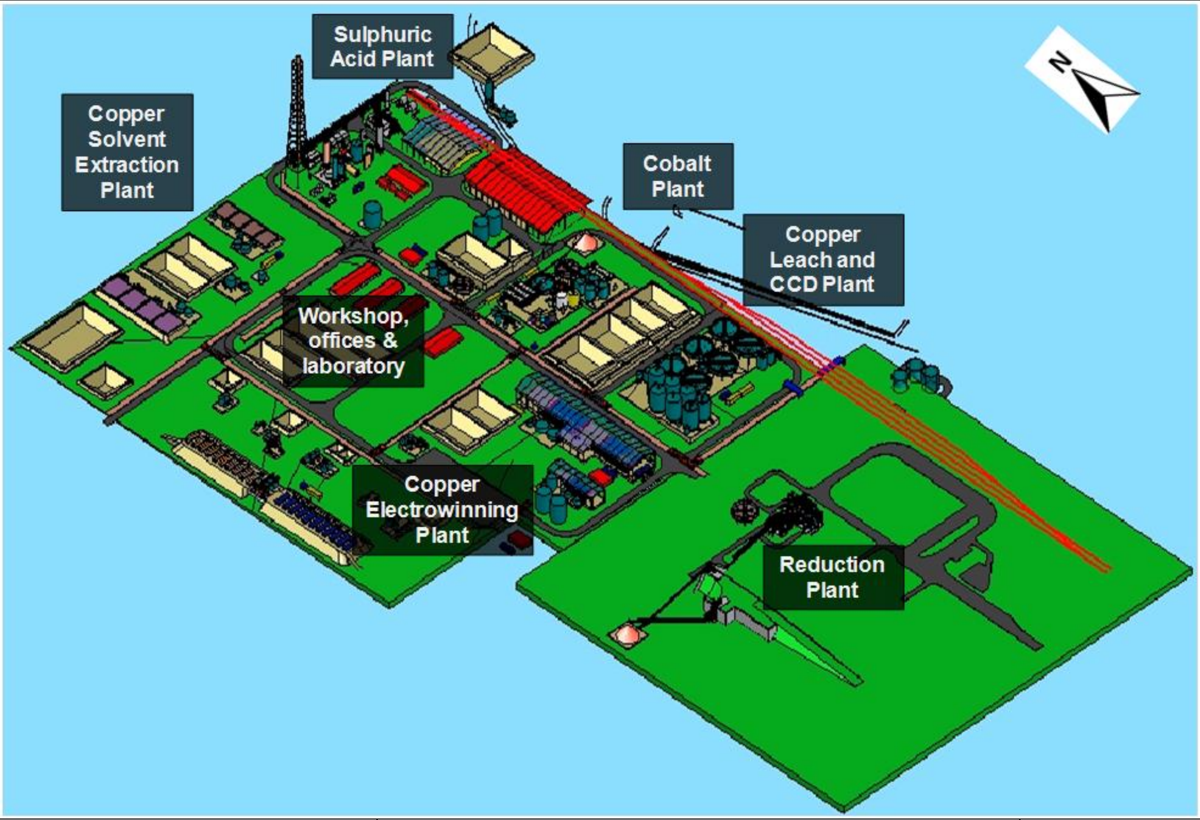
Metorex
Ruashi plant Simplified Flow Sheet

Project No.
453459

Figure 3.24: Ruashi Plant Simplified Flow Sheet



srk consulting	**Metorex** Isometric view of the Ruashi Phase II hydrometallurgical plant	Project No. 453459

Figure 3.25: Isometric view of the Ruashi Phase II hydrometallurgical plant

The targeted leachate copper tenor of 8-10 gpl copper to the HG circuit dictates that the leach circuit be operated at a solids content of approximately 22%. The agitators in the leach reactors ensure adequate solids suspension as to allow solids discharge via the tank overflows and to prevent localized leaching. The solution overflows from the first leach tank into the second leach tank where further SMBS solution is added. The SMBS 'reduces' the cobalt ions allowing the majority of the cobalt to be leached. The overflow from leach tank 2, reports to leach tank 3 and, similarly, the overflow from leach tank 3 reports to leach tank 4.

The larger solids that are pumped to the leach tanks build-up at the bottom of the leach tanks. These solids are removed using cropping pumps which pump the slurry to the following leach tank. The cropping tank from leach tank 4 pumps solids to the leach thickener feed tank and the leach 4 overflow also reports to the leach thickener feed tank.

The thickener feed tank feeds into the thickener feed well where it is mixed with flocculent. During the thickening process the solids from the leach slurry separate by gravity from the liquids. The result is that the heavier solids make up most of the underflow, which reports to the Leach Counter Current Decantation Circuit ("**CCDs"**). The lighter liquid fraction overflows from the thickener and reports to the Pinned Bed Clarifier where remaining suspended solids are removed. The liquid product is then stored in the High Grade Pregnant Leach Solution ("**PLS"**) Storage Pond.

The copper leach and CCD circuit is shown in Figure 3.26.

srk consulting	**Metorex** Views of reduction section showing SAG mill and ball mill combination (top); and copper leach and CCD circuits (bottom) (photos courtesy of Metorex)	Project No. 453459

Figure 3.26: Views of reduction section showing SAG mill and ball mill combination (top); and copper leach and CCD circuits (bottom)

- **Counter Current Decantation ("CCD") and Neutralization**

  The CCD process involves the separation of solids by way of a cascade of thickeners for continuous counter-current washing of the solids. The result is a concentrated pregnant leach solution (PLS) discharging from the cascade on the one end of the train and washed solids on the other.

  The CCD takes its primary input as thickened leached ore slurry, which is the underflow from the high density thickener that is located after the leach reactors. The 4-stage CCD circuit uses a wash ratio of ~1.5 m^3/t residue. The washed residue reports to the Tailings Neutralisation circuit prior to being pumped to the tailings dam. The "spent" wash solution that is generated by overflowing the first CCD is first clarified using a dedicated pinned bed clarifier and then stored in the Low Grade Pregnant Liquor Solution **("LG-PLS"**) Storage Pond.

  Following the CCD process, residue slurry reports to Tailings Neutralisation. The aim of this process is to neutralise residue slurries and precipitate any base metals left in these slurries before disposal to the tailings dam. Slurry is received from the CCDs and as well as from the Fe/Al and Magnesium Removal processes that form part of the Cobalt circuit. The pH of the residue slurry is adjusted with milk of lime (MOL) to above pH 8.0. There are two Neutralisation Tanks arranged such that overflow from the first tank will report via gravity to the second tank. Underflow slurries report to the first tank and the pH is adjusted.

The neutralised solids are pumped to the tailings dam. Due to high head requirements to the tailings dam, two centrifugal pumps in series are used to transfer the neutralised slurries.

- **Copper Solvent Extraction**

  The SX process involves the extraction of copper from a leach solution. This acidic leach solution contains soluble copper, cobalt and unwanted impurities. The product from the SX circuit is a copper sulphate solution which is purified and can be used in the electro-winning process to produce (LME A grade) copper.

  Extraction of copper from the solution occurs when diluted organic liquor is well mixed with the contaminated copper solution which is being pumped from the PLS pond to the SX circuit. When the regularly mixed, immiscible liquids pass through the cycle of extraction, washing, and stripping, a near-pure copper solution can be achieved.

  The copper SX is arranged as a split circuit (HG SX and LG SX) in order to reduce the acid and lime requirements of the plant. The HG SX treats the bulk of the copper in solution (75%) and therefore generates large amounts of acid, which is recycled back to the leach circuit. The LG SX treats the balance of the leached copper (25%) and therefore generates lower acid tenors in its raffinate stream and is therefore suitable for sending to the cobalt circuit where the acid is neutralised.

  Both the HG SX and LG SX sections comprise a two stage extraction, a one stage washing and a one stage stripping circuit. The extraction, washing and stripping equipment are conventional mixer-settlers.

  The HG SX raffinate, containing ~1 200 mg/l Cu and 20 gpl sulphuric acid, is recycled to the leach circuit to make use of the free acid. The LG SX raffinate, containing ~150 mg/l Cu and ~8 gpl sulphuric acid, is forwarded to the cobalt plant.

  The final step of the copper purification process is filtration of the advanced solution through Multi-Media Filters ("**MMF"**) in order to remove entrained organic so that an impurity-free, copper-rich aqueous solution reports to Electro-winning.

  An auxiliary process in SX is crud treatment. Crud forms in the settlers for a number of reasons and it is required to be treated in order to maintain settler capacity as well as to reduce loss of organic. Crud is processed in a centrifuge and both the organic and aqueous salvaged from this treatment process are returned to the SX circuit. The unwanted solids are disposed of in line with best practice procedures.

  It is essential to recognise the huge fire risk in the SX area. The organic reagent used for copper extraction is extremely flammable and any fire in the SX is likely to have catastrophic results. For this reason, the strict controls governing both entry into SX and SX maintenance must be enforced without compromise.

- **Copper Electro-winning**

  The EW circuit is the final stage in the production of (LME A Grade) copper. Advanced/loaded electrolyte is received from the SX circuit, and is pumped to the polishing cells. The overflow from the polishing cells reports to the Circulating Tank. Electrolyte is pumped from the circulating tank into each of the commercial cells. The overflow from the commercial cells reports to the Spent Electrolyte Tank.

  Copper is deposited from the loaded electrolyte onto stainless steel 'cathodes' when an electric current is passed through the cell. This current is supplied to the EW system first through a transformer and then a 12-phase rectifier. Once sufficient copper has deposited onto the stainless steel cathode, the cathode is hoisted out of the cell (see Figure 3.27) and so the copper can be 'stripped' off the cathode. Copper is stripped from the cells on a six or seven day cycle, depending on the growth rate of the copper cathode. During a strip cycle, only one third of the cathodes from a single cell are removed. These cathodes first pass through a wash stage where they are washed with high pressure hot water to remove any electrolyte and organic prior to the copper being stripped. The stripped stainless steel cathodes are replaced back into the cell.

  The copper cathode which is stripped from the cells are bundled and strapped as the final product.

  This is a business process that occurs once the production of copper cathode has been completed at Electro-Wining (EW). In the process copper cathode plates are cleaned, separated, packed for dispatch and loaded on to trucks to exit from the dispatch area. At this stage the material becomes the responsibility of logistics and is exported from the Ruashi Mine by truck.

  The tank house is of 'open' construction and therefore naturally ventilated. Acid mist formation is minimised by the use of floating plastic balls that float on the surface of the cells.

srk consulting	**Metorex** Views of loaded copper cathode in Ruashi EW tank house (top); and cobalt hydroxide cake being bagged for shipment (bottom) (photos courtesy of Metorex)	Project No. 453459

Figure 3.27: Views of loaded copper cathode in Ruashi EW tank house (top); and cobalt hydroxide cake being bagged for shipment (bottom)

Cobalt Plant

- **Iron and Aluminium Removal**

  The aim of the Iron/Aluminium Removal process is to selectively precipitate iron, aluminium and some manganese with minimal cobalt losses from the copper circuit bleed stream. Iron is precipitated in three reactors arranged in series under oxidative conditions using milk of lime ("MOL") and the introduction of a dilute SMBS/air mixture with the pH profile in the reactors being progressively increased. Aluminium is precipitated in a further reactor at a higher pH. Approximately 15% of the manganese in the bleed is taken down together with the iron and aluminium. Slurry from the final reactor reports to the Iron/Aluminium

Removal Thickener, where a flocculent is added. A fraction of the underflow from the thickener is re-circulated to the reactors for seeding purposes.

The iron removal reactors are arranged such that overflow from one reactor will report via gravity to the next reactor. Solids that build-up at the bottom of the tanks are removed using cropping pumps which re-circulate the slurry. Overflow from the thickener is forwarded to the Cobalt Precipitation process, while the thickened underflow, reports to a belt filter feed tank which feeds to two belt filters. The primary filtrate is returned to the thickener feed tank. The cake is washed and then directed a re-pulping tank and is thereafter forwarded to Tailings Neutralization.

- **Cobalt Precipitation and Magnesium Removal**

  The main aim of the process is to precipitate cobalt contained within the solution received from the Iron/Aluminium Removal process. Cobalt is precipitated using magnesia and caustic in four precipitation reactors arranged in series such that overflow from one reactor will report via gravity to the next reactor. Magnesia is added to Tank 1 at MgO:Co ratio of 1:1. Caustic is added to tanks 2 and 3. Precipitation is performed at a pH~ 8.2.

  Solids that build-up at the bottom of the tanks are removed using cropping pumps which pump the slurry to the following reactor. Reactor overflow slurry reports to the thickener feed tank before it gravitates down to the thickener. Flocculent is added at the thickener to aid solids settling. Thickener overflow solution gravitates to the thickener overflow tank where it is further transferred to a clarifier where suspended solids are removed and returned to the thickener feed tank. The overflow solution is transferred by pump to the cobalt Filter Press section. A fraction of the underflow from the Thickener is re-circulated back to the reactors for seeding purposes.

  It is necessary to remove the magnesium from the overflow which is done in the Magnesium Removal section. The magnesium content of this solution is precipitated with milk of lime in three agitated precipitation reactors. Magnesium removal slurry is fed from the reactors to a thickener. The thickener overflow solution gravitates to the Process Water Pond and the thickener underflow is transferred to Tailings Neutralisation.

  In both areas the reactors are arranged such that overflow from one reactor will report via gravity to the next reactor and thereafter to the thickener. In Cobalt Precipitation the tanks thus are arranged in such a manner that the first will overflow into the second and the third, while the second will overflow into the third and the fourth, the third will overflow to the fourth and the thickener feed tank. Solids that build-up at the bottom of the tanks are removed using cropping pumps which re-circulate the slurry reactor. Provision for bypassing tanks has been allowed for in the case of one reactor being unavailable; this will be done by changing of the valves.

- **Cobalt Salt Production**

  Underflow slurry from the Cobalt Precipitator, at 15% – 20% solids, is transferred to two Filter Feed Tanks. Filter Feed Pumps are used to transfer slurry to two Filter Presses. Moisture is separated from solids through application of air pressure. The solid product or Filter Cake is transferred to the Cobalt Drier via a conveyor.

  The Filter Presses work in a batch manner. They are loaded with slurry before completing a filtering cycle and producing a batch of solid filtered material, the Filter Cake. The solid is removed, the press re-loaded with slurry and the filtering cycle repeated. The filter press uses pressure to maximize the rate of filtration and produce a final filter cake with as low as possible water content. The moisture is currently 69% but with the new drying plant it is envisaged to reduce it to 15%.

  The Cobalt Hydroxide ($Co(OH)_2$), either directly from the Filter Press or having been routed through the Cobalt Drier, is packed (see Figure 3.28), prepared for dispatch and loaded on to trucks to exit from the dispatch area. At this stage the material becomes the responsibility of Logistics and is exported from the Ruashi Mine to Johannesburg.

Sulphuric Acid Plant

The sulphuric acid plant is a sulphur burning plant and currently produces sulphuric acid and SO_2. Ruashi Mine commissioned the SO_2 section in H1-F2013.

3.10.3 Plant Availability

The average plant running time for F2012 was 87.4%. The majority of the time lost (60%) was as a result of grid electrical failures (Table 3.20). When these failures occur, the plant must be restarted each time and about an hour of production time is lost while the plant is restarted.

Table 3.20: Ruashi - Breakdown time analysis for F2012

Item contributing to Down Time	Contribution (%)
In plant electrical	3.2
Instrumentation	1.3
Mechanical	13.3
Grid electrical	59.7
Planned Maintenance	14.0
Process	8.6
Total	**100.0**

3.10.4 Metallurgical Balance

The metallurgical balance, with the actual results achieved in F2011, F2012 and H1-F2013, the forecast figures for H2-F2013 and the budgeted figures for F2014 to F2015, is set out in Table 3.21.

Table 3.21: Ruashi – Historic and Budget Metallurgical Balance

Item	Units	F2011 Actual	F2012 Actual	H1-F2013 Actual	H2-F2013 Forecast	F2014 Budget	F2015 Budget
Ore feed	(ktpa)	1 257.7	961.7	546.9	704.2	1 409.0	1 436.5
	(ktpm)	104.8	80.1	91.2	117.4	117.4	119.7
Feed Grade – Cu	(%)	3.23%	3.22%	3.31%	3.23%	3.24%	3.22%
Feed Grade – Co	(%)	0.42%	0.49%	0.41%	0.37%	0.37%	0.45%
Plant Recovery – Cu (1)	(%)	85.0%	87.1%	88.8%	85.0%	85.0%	85.0%
Plant Recovery – Co	(%)	70.0%	69.3%	67.7%	71.0%	71.0%	71.0%
Metal produced – Cu	(kt)	34.5	27.0	16.1	19.3	38.9	39.4
Metal produced - Co	(kt)	3.7	3.0	1.5	1.9	3.7	4.6

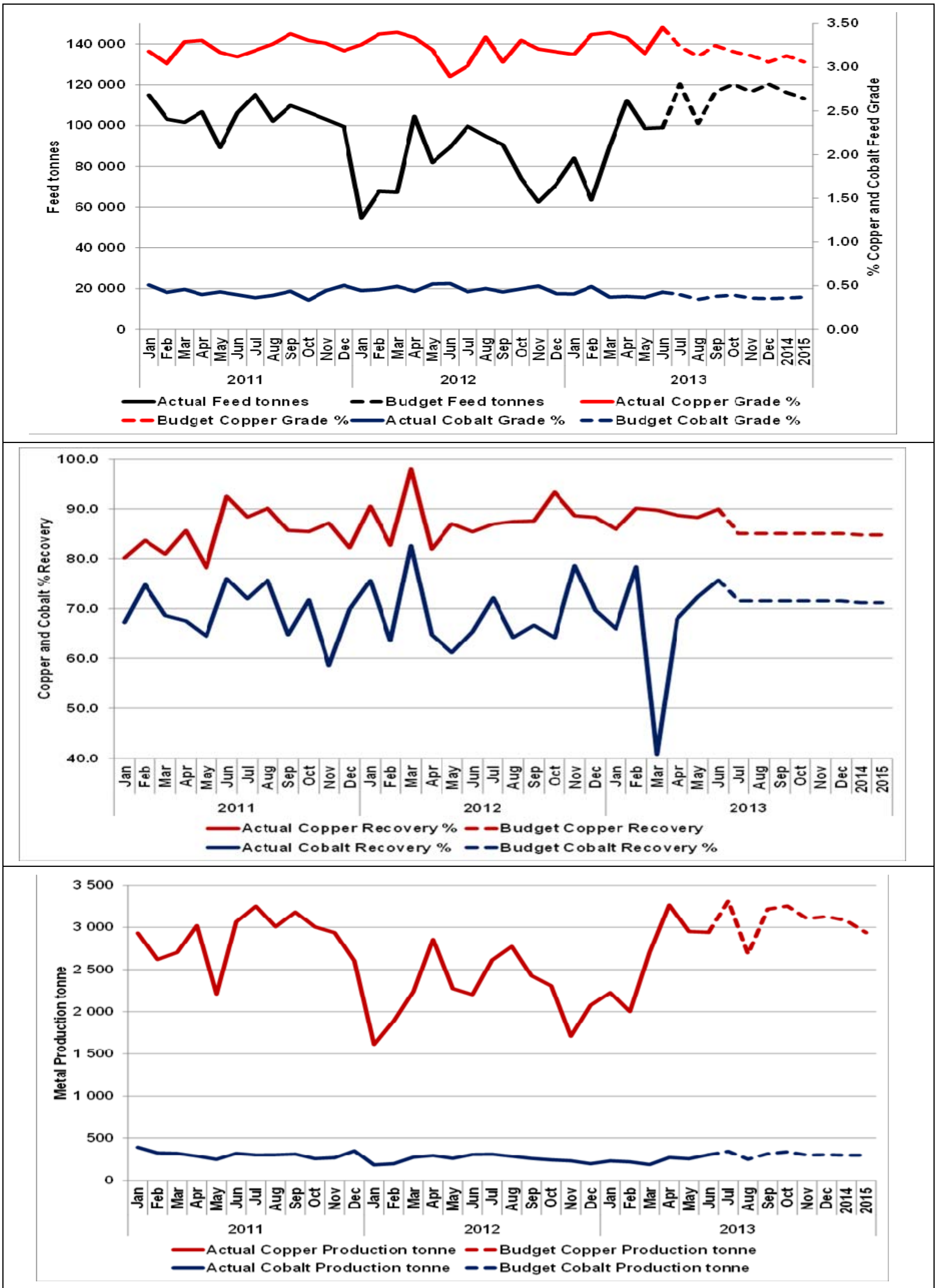
1 The higher Cu recovery reported in F2012 and H1-F2013 was achieved because of longer residence time in the leach circuit due to reduced plant throughput rates. This will not be realisable under normal plant throughput rates, so forecast Cu recovery for LoM is therefore kept at 85%,

The actual tonnage for F2012 in Table 3.21 is only 71% of what was originally planned, mainly due to the power interruptions suffered during F2012. The budget tonnage estimate for F2013 is seen to be reasonable given that Metorex rented 13 diesel-powered generators (13 MW) from Agrekko which were commissioned in February 2013. These were to be replaced by seven diesel-powered generators (15 MW) purchased from Caterpillar, to be commissioned in August 2013. Metorex has decided to purchase the 13 Agrekko units, which will make Ruashi effectively self-sufficient in terms of power supply. The budget tonnage estimate for H2-F2013, F2014 and F2015 is premised on improved power supply from SNEL due to various initiatives by mining companies in the DRC, coupled to the installed diesel-powered generators, but may be optimistic as these production levels have not been previously achieved (see Figure 3.28). De-bottlenecking of the leaching section was completed during H1-F2013 so that the current through-put rate was increased from an average of 150 tph to 175 tph.

The budgeted Cu head grades for H2-F2013 to F2015 (Table 3.21) are in line with what has been achieved previously, although the Co head grades are expected to be marginally lower than has been achieved in the past.

The budgeted Cu recovery for H2-F2013 to F2015 reflects past performance (Figure 3.28). The increased Co recovery is based on the the availability of SO_2 in the cobalt extraction.

The budgeted Co salt production for H2-F2013 to F2015 is in line with past performance at the Ruashi Mine (Figure 3.28). While the average Cu metal production for F2014 and F2015 was achieved in a number of months during F2011, this has not been achieved consistently throughout the entire year. This represents a challenge for the Ruashi Mine in F2014 and F2015. With a more consistent power supply, this should be feasible.



srk consulting	**Metorex** Ruashi Mine – Historic and Budget figures - Ore feed and Cu/Co Head grades (top), Cu and Co Recovery (middle) and Cu metal and Co salt production (bottom)	Project No. 453459

Figure 3.28: Ruashi Mine – Historic and Budget figures - Ore feed and Cu/Co Head grades (top), Cu and Co Recovery (middle) and Cu metal and Co salt production (bottom)

The F2012 budget called for 125 000 t of sulphuric acid and 10 658 t of SO_2 to be produced, which was not achievable due to the power interruptions. The budget for F2013 is much more realistic, with an envisaged production of 83 500 t of sulphuric acid and 9 794 t of SO_2. The leach plant consumption in F2013 is estimated to be 57 915 t sulphuric acid, with the balance available to be sold into offtake agreements that Metorex has in place.

3.10.5 Costs

Capital Cost Budget

The capital cost budget for H2-F2013 and F2014 is set out in Table 3.22.

The de-bottlenecking capital enabled the through-put rate of the leach section to be increased to 175 tph. This entailed the changing of the agitators in the leach tanks, the rake mechanisms from static to hydraulic, scum boards on the CCD vessels, changes to the flocculent addition, upgrading the underflow pumps and an additional CCD and leach tank.

Table 3.22: Ruashi – Plant Capital Cost Budgets for H2-F2013 and F2014

Process Capex	Units	H2-F2013	F2014
Processing			
Lab equipment (AA Machine)	(USDm)	0.24	0.10
SFD	(USDm)	0.80	
Cathode - replacement plates	(USDm)	0.18	
Debottlenecking	(USDm)	1.28	
Lime Pulverisor	(USDm)		2.00
CLE Floataion machine	(USDm)		0.50
Oil skimmers for SX	(USDm)	0.05	
IT distribution to plant	(USDm)	0.04	
Phase 2 "Red truck"	(USDm)		0.15
Capping blocks	(USDm)	0.18	
High Pressure washing system	(USDm)	0.30	1.00
Cathodes (1 000 off)	(USDm)	0.25	0.25
Replacement anodes (1 000 off)	(USDm)	1.00	0.25
Vehicule	(USDm)		0.07
Acid plant shutdown	(USDm)	2.44	4.43
Plant drainage / storm water control	(USDm)	0.10	0.06
Test work	(USDm)		0.30
Engineering			
Bakkie	(USDm)	0.07	
3 SCANIA buses	(USDm)		0.47
Concrete EW Floor	(USDm)	1.20	
Acid tanks	(USDm)	0.57	0.14
Plant corrosion rectification	(USDm)	0.05	
Sag Mill Trunnion ends	(USDm)	0.27	0.30
50T Crane	(USDm)	0.80	0.80
Sag mill hydraulic jacks	(USDm)	0.02	
2 ball mills motors	(USDm)	0.18	
Workshop mill	(USDm)	0.03	
Sulzer priming pots	(USDm)	0.26	
Aggreko gensets	(USDm)	5.40	
DMS test work	(USDm)	0.20	
Mobile DMS plant	(USDm)		1.50
Total New Capital	**(USDm)**	**15.90**	**12.31**

Operating Cost

The actual plant operating cost for the Ruashi Mine for F2012 was USD63.62 million (budget USD69.16 million) for plant feed of 962 kt (budget 1 352 kt). This deviation made the total actual cost lower than budget, but negatively influenced the unit costs with an actual plant cost of USD66.15/t feed (budget USD51.17/t). During H1-F2013, actual ore feed into the plant was 546.9 kt (budget 620.8 kt) at a plant cost of USD43.7 million (budget 32.8 million). Unit plant cost was then USD58.36/t feed relative to a budget of USD33.23/t, due to plant throughput and additional power costs for the Agrekko diesel generators.

During F2012, the opportunity was used to operate the cobalt circuit by itself during power restrictions to increase the cobalt recovery and purity. This practice meant that lime and caustic soda was consumed without the benefit of leach tonnes and as a result increased the unit costs of the plant.

The budget process plant unit costs at the Ruashi Mine for H2-F2013 to F2019 are set out in Table 3.23. The plant process costs reflect the inclusion of diesel-generated power in conjunction with line power supplied by SNEL (see notes below Table 3.23). Ruashi Mine plans to use limestone sourced in the DRC which will be pulverised on site, instead of relying on imported lime. Ruashi Mine has budgeted to generate a monthly saving of USD0.3 million on lime from F2015 onwards. SRK is satisfied that this saving can be achieved.

The use of sulphur dioxide, sulphuric acid for sale, 175 tph throughput rate, running time of 92% and 15% moisture in cobalt salt are key assumptions in the F2013 budget.

Table 3.23: Ruashi Mine – Unit plant processing and engineering costs – F2013 to F2018

Item	Units	H2-F2013	F2014	F2015	F2016	F2017	F2018	F2019
Process Plant [1,2,3,4]								
SX-EW process	(USDm)	36.90	71.10	66.01	64.71	64.89	64.14	43.66
Co process	(USDm)	18.27	33.16	33.91	39.66	37.14	25.98	23.34
Process Engineering								
SX-EW engineering	(USDm)	5.69	11.44	11.58	11.35	11.39	11.25	8.71
Co engineering	(USDm)	0.39	0.79	0.97	1.13	1.06	0.74	0.76

Notes:

1. Milling costs included in SX-EW costs.
2. Process plant costs in H2-F2013 are based on power costs made up of SNEL power at a cost of USD0.6 million per month, plus USD3.0 million per month for diesel generation as follows:
3. Power costs for F2104 to F2018 are the same as for F2013, less the monthly rental for the Aggreko generators of USD0.3 million, as Metorex will purchase these during H2-F2013. Incorporates a monthly saving of USD0.3 million resulting from use of pulverised limestone instead of imported quicklime.
4. Power cost in F2019 returns to normal supply from SNEL based on USD0.89 million per month from SNEL, plus USD1.0 million per month for diesel-generated power. Incorporates a monthly saving of USD0.3 million resulting from use of pulverised limestone instead of imported quicklime.

Off-mine / Realisation Costs

Following a review and re-tender of the Cu and Co clearing and export costs, two export clearing companies were appointed to handle the Cu and Co products, each handling 50% of the exported product. The revised contracts represented a saving in clearing costs of approximately USD100/t and USD86/t for Cu and Co respectively with effect from 1 January 2013. Actual results from H1-F2013 showed that transport costs for Cu has reduced, whilst clearing costs for Cu and Co had increased by around USD45/t and USD40/t respectively. The revised costs based on H1-F2013 have been applied in the off-mine costs for the Ruashi Mine for H2-F2013 to F2018 as shown in Table 3.24.

Table 3.24: Ruashi – Off-mine cost projections

	Units	H2-F2013	F2014	F2015	F2016	F2017	F2018
Transport costs	(USDm)	10.0	18.5	19.7	20.3	20.0	18.1
Clearing costs	(USDm)	5.4	9.7	10.6	11.2	10.9	9.5
Total off-mine/realisation costs	(USDm)	15.4	28.3	30.3	31.5	30.8	27.5

3.10.6 SRK Comments

- The metallurgical balance can be accepted provided that the tonnage can be delivered to and treated by the leach plant. There are a number of assumptions that must be realised:
  - Phase 1 de-bottlenecking is successful – Metorex is on track for this to be completed by September 2013;
  - Power supply problems are solved. Metorex had entered into a 6-month lease agreement with Agrekko for diesel powered generators to supply 13 MW, until such time as the new Caterpillar diesel powered generators it had ordered can be commissioned. The Caterpillar generators will be commissioned in August 2013. Metorex has decided to purchase the Agrekko generators in H2-F2013;

  - Sulphur dioxide section can operate continuously. This plant has been commissioned and is operational. Management has scheduled two months' routine shutdown of the plan per year, during which time SMBS is used instead of the SO_2;
  - Running time is 92%. SRK is satisfied that this should be achievable due to the improved power supply;
  - Cobalt % recovery of 71% is realised. If the low Co recovery in March 2013 is excluded, Ruashi exceeded the target Co recovery in H1-F2013. SRK is satisfied that this recovery is achievable.
- The operating unit cost estimate can be accepted provided the production is there to support the budget. This is dependent on a number of assumptions that must be realised:
  - Cobalt dryer must be commissioned to reduce the moisture from 69% to 15% and save on transport costs. The first two flash driers have been commissioned and have reduced the moisture content as planned. The savings on transport costs should now be realisable;
  - Sulphur dioxide must be available to save on SMBS costs;
  - Sulphuric acid available for sale. Management is confident that the acid plant will produce acid in excess of the Ruashi Mine's requirements and be sold according to off-take agreements;
  - Diesel supply must be realised at the estimated cost and quantities. Metorex had initiated a tender process to secure sufficient diesel for the diesel powered generators. Metorex has received written confirmation that the suppliers will be able to meet the increased diesel demand due to running 20 diesel-powered generators.
- The risks that have been identified for the leach plant are:
  - Power dips affecting the availability of SO_2. With more stable power supply due to the 20 diesel powered generators, mine management should be able to be able to produce at normal levels;
  - Steam supply to dryer affected by power dips. Management does not foresee any problems with the generation of steam once the acid plant is operational. The superheater has been identified for replacement in the next major acid plant shutdown in F2014 to ensure a continued supply of steam;
  - Katanga grid power requirements do not get priority. Metorex confirmed that it is working closely with the DRC Government and other stakeholders to make security of grid power a priority and many initiatives are underway in an attempt to stabilise grid power.

SRK is satisfied that the budgeted target plant feed can be achieved, even though the plant throughput was considerably lower in F2012. The commissioning of the diesel-generator sets in F2013 will effectively make Ruashi self-sufficient in terms of power supply, thereby minimising the effects of the power interruptions that plagued production in F2012. As SNEL power becomes more reliable with the interventions by mining companies in the DRC, Ruashi's reliance on diesel-generated power will reduce with accompanying reduction in operating costs.

3.11 Tailings Storage Facilities

[SR5.6]

3.11.1 Introduction

The Ruashi Tailings Dam (Phase 1) was designed by Golder and commissioned during 2006, while the Phase 2 facility was commissioned during 2008. To date approximately 6.5 Mt has been deposited in the impoundment.

No recent detailed plans of the tailings dam where available, that indicated the overall dam footprint, the location and elevation of the decant intake structures or the operating pool. The plan presented to SRK was dated March 2011. The SRK team was informed that no recent surveys have been undertaken on the tailings dam facility. The only additional plans that were available formed part of the design report, the Metorex CPR effective 01 January 2011 and a Google satellite image.

The Ruashi Mine operational tailings dam has a footprint of approximately 80 ha in a near square configuration. The tailings dam incorporates ring dyke containment walls, penstock decant structures, wooden catwalks, a single gravitational penstock pipeline and a 2 compartment HDPE lined RWD complex.

The old historical (Gécamines) tailings dam located approximately 800 m to the south west of the process plant was not inspected. This historical tailings dam forms part of the mine's reserves, meaning this facility will be reprocessed and deposited at some later stage on the current operational tailing dam facility.

3.11.2 Geometry

The eastern closure wall, which was developed across the lowest topographical portion of the site generally on contour, is some 1.0 km long, while the northern and southern sides/flanks are of the order of 0.8 km in length each.

Engineered outer embankments have an overall downstream slope of approximately 1 vertical to 3 horizontal. The outer tailings walls are being packed out at 1(v) : 2(h) with 7 m wide step-ins every 9 m in height. The tailings dam currently has a single step-in.

Wall raising uses a day wall deposition method that allows sufficient time for consolidation and packing of tailings, which then form the outer walls.

3.11.3 Slurry Pipelines

The slurry delivery line comprises one adequately sized 250 mm OD HDPE pipeline, which feeds slurry from the process plant to the distribution ring-feed. The ring-feed is also 250 mm OD HDPE pipeline, with a material rating PE100, PN 10. The total length of the ring-feed is approximately 880 m and includes eight discharge points. The piping observed on site was in good condition.

3.11.4 Capacity and Rate of Rise

SRK has reviewed the current Ruashi Mine tailings disposal system and is of the opinion that there is sufficient capacity on the Ruashi tailings dam to accommodate the 16.7 Mt of tailings from the Ruashi Mine for the projected LoM. Taking into account an average surface area on top of the dam during that period, the expected rate of rise will be between 1.4 m and 2.1 m per annum, well below the specified 3.0 m per annum in the design report. The height of the dam is therefore expected to increase by no more than 21 m over the project life of mine giving a total projected height below 40 m, which is acceptable.

What may be of concern is the structural integrity of the interlocking ring penstock decant structure, as the industry norm is a maximum height of 25 m. Therefore the construction of an elevated penstock should be considered within the next 5 years, in order that the tailings facility can be operated until the projected end of LoM in 2024. It was reported during the site inspection that both the penstock decant intake structures are to be internally sleeved in the near future, which may negate the need for a future elevated decant structure and penstock pipeline.

3.11.5 Seepage

There was no evidence of uncontrolled seepage occurring around the perimeter of the facility. In isolated areas there is evidence of potential seepage resulting in aquatic reed growth and in areas sand bags have been installed to block and prevent future piping formation. The piezometers do not indicate any untoward high phreatic surfaces in the outer embankments.

3.11.6 Rehabilitation

Three quarters of the perimeter outer walls have been effectively rehabilitated with a local grass species under natural dry conditions (no irrigation practised), therefore a rising green wall is in place.

3.11.7 Water management

Due to the potential seepage concerns along the eastern and southern flanks, the south eastern decant intake structure was decommissioned in favour of the north western decant intake structure. This has resulted in the containment of the operational pool slightly towards the western and northern flanks over the tailings dam. Both decant intake structures are connected to a common 525 mm NB reinforced concrete pipeline that has been designed to decant the calculated 1:50 year (24 hour) recurrence storm event in 72 hours. At the discharge point of the penstock pipeline the water can be directed, via a splitter box, into either of the return water dam compartments.

During the October 2012 site inspection, the pool size and depth of water on the top surface of the tailings dam facility was extremely small (approximately 1 ha) and shallow (less than 150 mm maximum depth) respectively. The decanted water was extremely clear, indicating exceptionally good beach formation, pool and decanting control.

The total freeboard on the tailings dam was estimated to be approximately 5.0 m, relative to the historical minimum of 3.5 m. This provides the necessary safe storage, even under a 1:100 year storm recurrence interval.

There is a formal system of storm-water management on the outer slopes of the tailings dam with the construction of a 7 m wide berm step-in and the installation of numerous berm storm water decant structures and associated down slope drainage pipes.

3.11.8 Basin Management

The operational top surface of the tailings dam covers an area of approximately 69 ha and consists of approximately 10 ha of day-wall paddocks and some 59 ha basin. Wet beach deposition of the Ruashi. Mine tailings dam covers up to approximately 25 ha leaving 44 ha of dry tailings where the upper crust is susceptible to dust generation.

The dust blow areas are of concern to the mine. There are several methods of retarding the level of dust blow of tailings dams, but the most cost effective and successful is a perimeter wet beach operation. It also allows the upper perimeter of the tailings dam to be raised in a controlled manner with freeboard development a priority. During the previous two years, planned wetting of the beach at the Ruashi Mine has occurred on an ad hoc basis only. There is no formalized dust suppression programme being planned.

It would therefore be beneficial that an overall deposition and rehabilitation strategy be developed and implemented which will not only fulfil the requirements for stability and safe operations but which also meets DRC environmental legislation requirements

3.11.9 Stability Analysis

A Design Continuation Report was compiled for the TSF by Golder Associates in 2012. This report concludes that:

- The TSF classifies as a high risk facility but its stability classification is low hazard;
- The TSF was being operated with sufficient freeboard at the time that the report was compiled;
- The stability of the TSF was acceptable at the time that the report was compiled; and
- Return water facilities were inadequate at the time that the report was compiled.

Upgraded return water facilities were recommended in the report, as well as a review within two years of operation of tailings characteristics, return water capacity and all design parameters and assumptions.

3.11.10 Return Water Dam

The RWD capacity was designed with a maximum storage capacity of 540 000 m^3 which is based on the water balance (a return water flow, equivalent to 70% of tailings solution, a 1 in 50-year storm water event, and evaporative losses). The actual RWD installation consists of two HDPE lined dams located side by side.

It was reported that a water management strategy is being implemented which will include the RWD. Overtopping of the RWD has occurred at least once since commencement of operations with an event reported in 2008. This must be seen in the light of the findings by Golder that return water facilities are inadequate.

3.11.11 Capital and Operating Costs

All future wall raising is done as part of the operational costs, so no capital expenditure is required.

SRK could not find any provision in the capital budget for the relining of the RWDs (section 3.11.10) and the installation of sleeves to the penstock towers (section 3.11.4), which may eliminate the need for a future elevated penstock. The capital costs associated with the lining of the Ruashi Mine RWDs was initially obtained from the mine and the tailings dam operator. SRK then checked the areas to be relined and applied marked related supply and installation costs to determine the capital cost. SRK estimates that the cost for this work would be approximately USD 4.5 million. SRK has added this capital amount, split equally between F2014 and F2015.

Thereafter, a sum of USD0.15 million should be included in the future annual operational budgets for general repairs and maintenance to the tailings dam facility.

The tailings depositional operating costs, including the external tailings dam operators (Fraser Alexander), would be approximately USD0.50/t placed. This would equate to an annual operating expenditure of USD 0.15 million.

3.11.12 SRK Comments

SRK has reviewed the current Ruashi Mine tailings disposal system and is of the opinion that there is sufficient capacity on the Ruashi Mine tailings dam to accommodate the 16.7 Mt of tailings from the Ruashi Mine for the projected LoM.

Operational and storm water management of the tailings dam is very good based on observations made on site.

The tailings dam is currently being operated by mine and external personnel. Various aspects of the current and future operations of the tailings disposal system will require particular attention, for example:

- Continued re-equipping and refurbishment of the slurry pump stations to meet the operational demands;
- Maintenance of freeboard around the entire perimeter of the facility, especially on the eastern and southern flanks/faces of the dam as these are the faces that are susceptible to localised seepage/formation of localised piping failure.
- Monitor the isolated seepage areas that are moist and where aquatic reed growth is present;
- Continued rehabilitation of the outer slope and the berm step-ins with the natural grasses, that has been so successful to date;
- Continued monitoring of piezometers on a regular monthly basis to determine if the phreatic surface in the outer walls increases with time; and
- Carry out a stability analysis of the eastern closure wall at the highest section of the dam based on actual phreatic readings and under a non-functioning drain situation up to and including LoM terminal height.

If attention is given to the above issues, the existing tailings disposal system will meet the Ruashi Mine impoundment requirements for the predicted 12 year LoM. Metorex has confirmed that an audit will be conducted in F2013 which will address the issues raised by SRK.

3.12 Infrastructure and Engineering

[SR5.6]

The main arterial road from Kasumbalesa to Lubumbashi was upgraded by Chinese contractors in 2010. As a result, access is now greatly improved. Border control at Kasumbalesa between the DRC and Zambia has also been upgraded and service has been improved, but still remains a concern.

Lubumbashi lies along the transcontinental railroad system and has access to both the east and west coast ports of Angola, Tanzania, Mozambique and South Africa. Rail infrastructure and rolling stock owned and operated by Société Nationale des Chemins de Fer du Congo ("**SNCC**"), the state owned national railway company, is however in poor condition. Rail services are unreliable. As a result the vast majority of consumables and finished product (copper cathode and cobalt carbonate) are moved by road transport. Water to the mine is supplied from underground aquifers. The geology is largely dolomitic and significant quantities of subsurface water are available.

3.12.1 Electrical Infrastructure

The DRC has hydroelectric power resources which are regulated and supplied by SNEL, the national power utility. Ruashi Mine is fed at 220 kV (40 MVA) by a dedicated power line from SNEL's "Inga" sub-station. The hydroelectric power plants have underperformed due to recent low river and dam levels, and infrastructure failures.

As part of the Phase II capital program, Ruashi Mining spent some USD11 million in upgrading SNEL's main supply sub-station in Lubumbashi. Despite this investment, the power supply to the mine suffers from under voltage and unstable voltages, resulting in equipment failures and prolonged power outages.

The mine is presently supplied with power from two other sources in from Zambia, from both the Zambian Electrical Supply Commission ("**ZESCO**") and the Copperbelt Electrical Corporation ("**CEC**"). CEC supplies up to 8 MW between the hours of 6am and 6pm and is a more reliable, stable supply than SNEL. The ZESCO supply (8 MW) can supply between 10pm and 6am. Both the Zambian supplies suffer from low supply availability into the DRC, due to restrictions and maintenance issues. The SNEL supply is presently 10 MW – 12 MW, supplying the mine between the hours of 10pm and 6am. The electrical infrastructure within the DRC is very poor and often very unreliable. The mine is situated at the end of a long 220 kV industrial distribution line, which is heavily overloaded, resulting in an unreliable, unstable supply to the mine. The mine had a number of power outages during the visit by SRK representatives.

The mine sub-station is equipped with two 40 MVA 220 kV to 15 kV step down transformers, which supply the surface and open pit pumping operations with 525 V. The only power supply requirement at the open pits is for dewatering pumping. All in pit lighting is from portable diesel generator lighting masts, one set is allocated to each of the four sets of mining loading and hauling equipment. The present site load is approximately 15 - 16 MVA.

The mine has suffered from the following problems, due to deteriorating electrical infrastructure:

- Rural demand outstripping supply capability, 100 MW available against a regional demand of approximately 600 MW;
- Many power outages, affecting plant operations, recoveries adversely affected in the plant;
- Electrical components (motors, switchgear, etc) suffering premature failures as a result of unstable, under-voltage supplies from the grid;
- Many electrical control and electronic equipment failures, due to repeated outages and unstable supply. Harmonics are responsible for various variable speed drive units ("**VSDs**") failing.

Generally, the Zambian supply is more stable and reliable than the DRC supply. In the future, the SNEL supply distribution is planned to receive various infrastructural upgrades, which will result in further extended outages to the Ruashi operations.

The Ruashi Mine had a number of back-up diesel generators with a combined generation capacity of 4 MW, which was sufficient to provide emergency power for agitation of the thickeners and leach tanks, as well as a trickle charge to the EW tank-house. In the event of a power failure, the crushing and milling sections were not operated. However, over time the units have become unreliable, due mainly to their age (running hours since new), as well as being operated continuously thereby exceeding their duty cycles. The generators were originally planned to run for up to 400 hours per year. At end September 2012, the generators had already run over 1 200 hours in F2012. To further illustrate the extent of the undersupply and unavailability of power, the power supply issues for the period March to end of August 2012 are summarised in Table 3.25.

Table 3.25: Ruashi Mine – power supply issues March to August 2012

Month	Nominated maximum demand (MW)	Average power supplied (MW)	No of outages	Total time off
March 2012	15.83	10.14	44	73h53
April 2012	17.81	13.57	6	3h56
May 2012	18.06	11.57	24	18h42
June 2012	16.96	10.31	35	10h39
July 2012	16.92	13.10	20	16h39
August 2012	16.84	12.06	28	27h59

In an effort to improve the availability of power supplies on the site, the mine rented thirteen 1.0 MW dieselgenerator units from Agrekko. The introduction of these units in February 2013 has had an immediate impact on improving the power availability to 99.8% since being commissioned. Table 3.26 serves to illustrate the improvement made in the power availability on site.

Table 3.26: Ruashi Mine – improvement in the power availability

Month	Number of SNEL trips	Total off time	Availability (%)-SNEL	Availability (%)-with Aggreko units running
March 2013	41	37H17min	93.0	99.9
April 2013	57	57H57min	90.1	99.7
May 2013	82	105H15min	80.1	99.84
June 2013	58	63H42min	87.9	99.95
July 2013	60	55H04min	89.6	99.86

The mine has purchased 7 new 2.25 MVA Caterpillar diesel generators to upgrade its present on site diesel generation capacity, which can also cogenerate power with SNEL. The units will be commissioned by August 2013. Metorex has since decided to purchase the 13 Agrekko units during H2-F2013, which will mean that the mine will be effectively self sufficient in power supply.

The present tank farm capacity must be expanded to ensure an adequate amount of diesel is stored, which means that due consideration must be made regarding the logistics involving diesel supplies across the border in the rainy seasons.

SRK suggested to mine management that detailed discussions need to be had with Caterpillar Project teams, to ensure that diesel consumption is optimised for the duty required. Experience elsewhere in Africa shows that fast running generators are being replaced with larger slower running units that consume less diesel/kWh. Due consideration should also be given to entering into an operational and maintenance contract for power, whereby Caterpillar designs, supplies, installs, operates and maintains the power plant, with the mine paying per kWh supplied.

3.12.2 Bulk water supplies

Bulk service water for the surface plant and infrastructure is supplied from the following sources:

- Surface drill holes;
- Return dam water from the TSF;
- In pit dewatering pumps;
- Open pit dewatering drill holes.

The tailings dewatering system supplements this water, all of which is discharged into the surface "Coffer dam". A small percentage of the drill hole water is treated and stored in sealed and vented storage vessels for potable use. There are ample water resources available, to support all the mining and processing operations at the Ruashi Mine.

3.12.3 Surface Infrastructure

Generally, the surface infrastructure was maintained well, with no serious defects noted at the time of the visit. The offices, stores, change-houses, etc were adequately sized for the scale of operations at the Ruashi Mine.

The main engineering surface workshops consisted of a mobile workshop and a machine workshop, which comprised of the following key equipment:

- Large 6 bay fully equipped mobiles workshop, to support the mine's mobile vehicle fleet, 3 bays were covered with a sheeted roof and equipped with a 10 t mobile overhead crane. A further three maintenance bays were in the open, and used mainly for boiler-making work and servicing;
- A 12 m wide x 60 m long fully sheeted fitting, electrical and main machine shop, equipped with a 12.5 t electric powered overhead crane that covered the entire workshops facility. The machine shops contained a pump repair bay, a plate guillotine, a band saw, a pillar drill, lathes, plate profilers, several build up/repair work benches and a powered press. New equipment was being installed into the workshops during SRK's visit. The machine shop was almost completed at the time of the visit;
- Situated adjacent to the machine shops, was a fully equipped boiler-making workshop, which supported both the mobile equipment and the processing facility.

Generally, the workshops are constructed and equipped to match the needs of the mining and processing activities at the site.

3.12.4 Engineering maintenance planning

The Delta computerised maintenance management system ("**CMMS**") is presently being upgraded for completion by July 2013. A review of progress with completed work and time consumed indicates the project is on track to be completed in the planned time period.

To achieve the planned upgrade, the planning department has two dedicated planning co-ordinators working on this system on a full-time basis. The day to day planned maintenance scheduling is time based and the two data inputters complete and close off all the completed planned job cards. The job cards are checked by the planning supervisor, prior to inputting data and closing off the completed job cards.

Up to 2 years of completed job cards, are stored in a secure place in hard copy format.

The need to upgrade the maintenance planning systems was recognised when the following parts of the maintenance management system were seen to be failing:

- The asset register was being completed in line with the CMMS upgrade plans;

- Foreman and supervisors have been allocated cost/work centres to better monitor equipment perfomance;
- The system does not allow a department to drill down and interrogate individual equipment and work centre costs. Cost information is provided in high-level summaries in the monthly accounting reports, which are not split down to individual machines. Efforts are underway to refine the system further;
- Stock codes and bills of materials are being set up to easily identify equipment types or spares types. This will decrease the time used to find spares in the stores, when trying to carry out repairs on machinery. The stock codes should also be linked to a bin system, to direct the artisan to the correct bin in the stores, thus saving valuable down time;
- The engineering stock codes should be cross referenced to the stores stock codes, so that both the CMMS and the accounts systems can talk to each other;
- Bills of materials need to be compiled for each piece of equipment on the asset register. This again will allow the artisan quicker access to stock information;
- The stores bin system is in need of improvement, to ensure that engineering staff have quick access to stock items in a breakdown situation.

Presently, the planning department holds weekly maintenance planning meetings on Thursdays, with the production and maintenance supervisors and managers, to plan and agree on the forthcoming weekly maintenance priorities.

3.12.5 Open cast mining operations

The Ruashi Mine pits are mined by the mining contractor MCK, who appeared to be well organised and well managed, when their operations were reviewed as part of the site visit.

The equipment appeared to be well maintained. The loading and hauling equipment was well matched, with 3 to 4 excavator loads required to fill each 40 t ADT. The operators appeared to be well trained and very little, if any, equipment damage was evident at the time of the visit. The contractor has its own purpose built workshops and is responsible for all the maintenance and repairs.

The average equipment availabilities for the period October 2011 to May 2012 for the in-pit loading and hauling equipment was reported to be as follows:

- Dozers 48% to 80%;
- B50 ADT trucks 65% to 85%;
- Excavators 50% to 85%.

The large fluctuations tend to suggest that stores stocking levels and logistics problems (cross border clearance, etc) have had the biggest impact, resulting in a negative influence on the equipment availability, more than poor maintenance or damage issues.

The open pits at the Ruashi Mine are accessed from a 1 km haul road extending from the process facility to the Pit I access ramp.

Power is supplied at 15 kV from the main sub-station via an overhead transmission line. Local 15 kV to 525 V step down transformers and switching panels, supply power to the various dewatering drill hole pumps situated in Pits I, II and III. The pumps dewater the ground and keep ground water levels below the mining bench levels. The open pits are surrounded by 2 m high berms, to prevent the ingress of storm water run-off entering the open pits.

3.12.6 Processing scheduled plant maintenance

All the process plant maintenance is scheduled on the Delta CMMS system by the Engineering planning department. All schedules are issued on timed basis, with all completed job cards inputted and closed out by the planners.

The monthly Engineering reports for periods from March 2012 to May 2012 were reviewed and the following points noted:

- The plant suffered extended plant outages due to the inability of SNEL to supply reliable electrical services.
- Milling and crushing availability was very low for two of the three months, which was solely due to power supply problems.

Table 3.27 illustrates the effect of the power supply problems caused by SNEL outages to the plant operations.

Table 3.27: Ruashi Mine - Effect of power supply problems on plant availabilities

Plant area	Actual Availability (%)			H1-F2012 Availability (%)	
	March 2012	April 2102	May 2012	Actual	Budget
Milling & crushing	58.0	84.6	66.4	72.6	90.0
Leach & CCDs	79.8	88.1	85.4	82.2	90.0
Solvent extraction	79.7	90.4	85.4	82.2	88.9
Electro winning (rect A)	93.8	87.6	93.4	87.3	88.9
Electro-winning (rect B)	92.8	88.2	93.4	87.3	88.9
Cobalt	89.2	89.5	92.1	85.9	88.9

3.12.7 Capital and Operating Costs

The capital cost budget for the Ruashi Mine for H2-F2013 and F2014 is set out in Table 3.28.

Table 3.28: Ruashi Mine – Capital cost budget – administration and infrastructure

Admin Capex		H2- F2013	F2014
Generators	(USDm)	2.23	
SHEC / security	(USDm)	1.87	0.56
HR	(USDm)	0.03	
Supply chain	(USDm)	0.01	0.05
IT	(USDm)	0.91	0.24
Musonoi	(USDm)	2.73	4.06
Total new capital	**(USDm)**	**7.77**	**4.91**

The budgeted administration and infrastructure costs for H2-F2013 to F2018 are shown in Table 3.29. There are a number of expatriate vacancies at the Ruashi Mine which will not be filled during F2013, which represents a reduction in the salaries and wages cost for F2013. In keeping with its agreement with the DRC government to develop local skills, the Ruashi Mine will implement further reductions in manpower costs in F2014.

Table 3.29: Ruashi Mine – operating costs – administration and infrastructure

Item	Units	H2-F2013	F2014	F2015	F2016	F2017	F2018
Salaries & wages	(USDm)	15.6	29.0	29.0	29.0	29.0	29.0
Administration costs	(USDm)	7.6	15.2	14.2	14.2	14.2	14.2
Social spend	(USDm)	3.3	6.1	2.0	1.0	1.0	1.0
Consulting/Management Fees	(USDm)	1.9	5.0	5.0	5.0	5.0	5.0
SHEC	(USDm)	1.7	3.2	3.2	3.2	3.2	3.2
Total admin & infrastructure	**(USDm)**	**30.1**	**58.5**	**53.4**	**52.4**	**52.4**	**52.4**

Metorex has provided for a training initiative during F2013 and F2014. The costs for this of almost USD1.0 million per annum are no longer required from F2015 onwards.

3.12.8 Conclusions

The main issue that faced the management of the Ruashi Mine in 2012 was the poor availability of electricity in the region. The mine has increased the installed diesel generation capacity on site to around 23 MW, which has drastically reduced the mine's reliance on SNEL and ZESCO for power.The introduction of the Agrekko diesel generators has drastically improved electrical power availability to the site.

The planned maintenance system needs to be refined to improve the engineering department's ability to report on equipment costs and work history. Presently unplanned job cards are not religiously completed, but the CMMS upgrade plans are in place and work is underway to include unplanned jobs cards in the reporting structure going forward. SRK supports the upgrade project presently underway at the Ruashi Mine, which if followed through should address the CMMS shortfalls outlined in the CPVR.

3.13 Logistics

[SR5.6]

Currently all the Cu and Co product being produced at the Ruashi Mine is transported to market by either rail or road vehicles. Previously the majority of the produce was transported by rail. However, the railway systems have lately become less reliable and more use is being made of road vehicle transport.

Possibly the highest logistics risk that the Ruashi Mine faces is the extended periods that road vehicles have to endure at the DRC-Zambia border crossing point, especially the fuel (diesel) vehicles, necessary to power the mining fleet and the standby generators. Metorex had initiated a tender process to secure sufficient diesel for the diesel powered generators. Metorex has received written confirmation that the suppliers will be able to meet the increased diesel demand due to running 20 diesel-powered generators.

3.14 Human Resources

[SR5.3, SR5.4C, SR5.5C]

3.14.1 Operating Structure

The year end audit pack for the Ruashi Mine showed that there were 1 256 permanent employees in service at December 2012. In addition, there were 1 159 casual and contract workers engaged at Ruashi Mine.

The distribution of the permanent employees within the different departments is shown in Table 3.28.

The majority of the staff reside in Lubumbashi and surrounding villages. Ruashi Mining has established a small camp which accommodates expatriates staff, certain contractors and standby engineering staff.

3.14.2 Mine Establishment

The budgeted mine establishment for F2013 to F2015 is set out in Table 3.30. The monthly productivity indices per total employee costed **("TEC")** are also shown in Table 3.30.

Table 3.30: Ruashi Mine - Mine Establishment for F2013 to F2015

Department		F2013	F2014	F2015
Mining		86	86	86
Processing		637	637	637
Engineering		178	178	178
Administration		152	152	152
SHEC		122	122	122
Logistics / supply		87	87	87
Total mine establishment		**1,262**	**1,262**	**1,262**
Productivity indices:				
RoM ore	t/TEC/month	153.8	171.2	99.3
Cu produced	t/TEC/month	2.2	2.5	2.6

3.14.3 Productivity Assumptions

The productivity statistics for the Ruashi Mine are estimated to average 160 tonnes processed per TEC per month and 2.5 tonnes of copper cathode per TEC per month (see Table 3.29).

3.14.4 Termination Benefits

In terms of labour legislation in the DRC, Ruashi Mining is required to provide termination benefits to its staff according to the following principles:

- Category 1-5 — 14 days plus 7 days per completed year of service
- Supervisor / Foreman — 1 month plus 9 days per completed year of service
- Manager — 3 months plus 16 days per completed year of service.

On this basis, Ruashi Mining has assumed a 6 month obligation at the end of the LoM. SRK considers this to be reasonable given the available information.

3.14.5 SRK Comments

The current LoM plan includes an allowance for the potential terminal benefits liability which may be incurred on closure. The risk that this may be understated is considered to be low. Metorex has advised SRK that these termination benefits are conservatively estimated and reviewed on an annual basis.

3.15 Occupational Health and Safety

3.15.1 Safety, Health, Environment and Community ("SHEC") Management Policy

The discussion which follows has been extracted from Metorex's "*All Mines - Health and Safety Plan*", as revised in February 2013.

Background

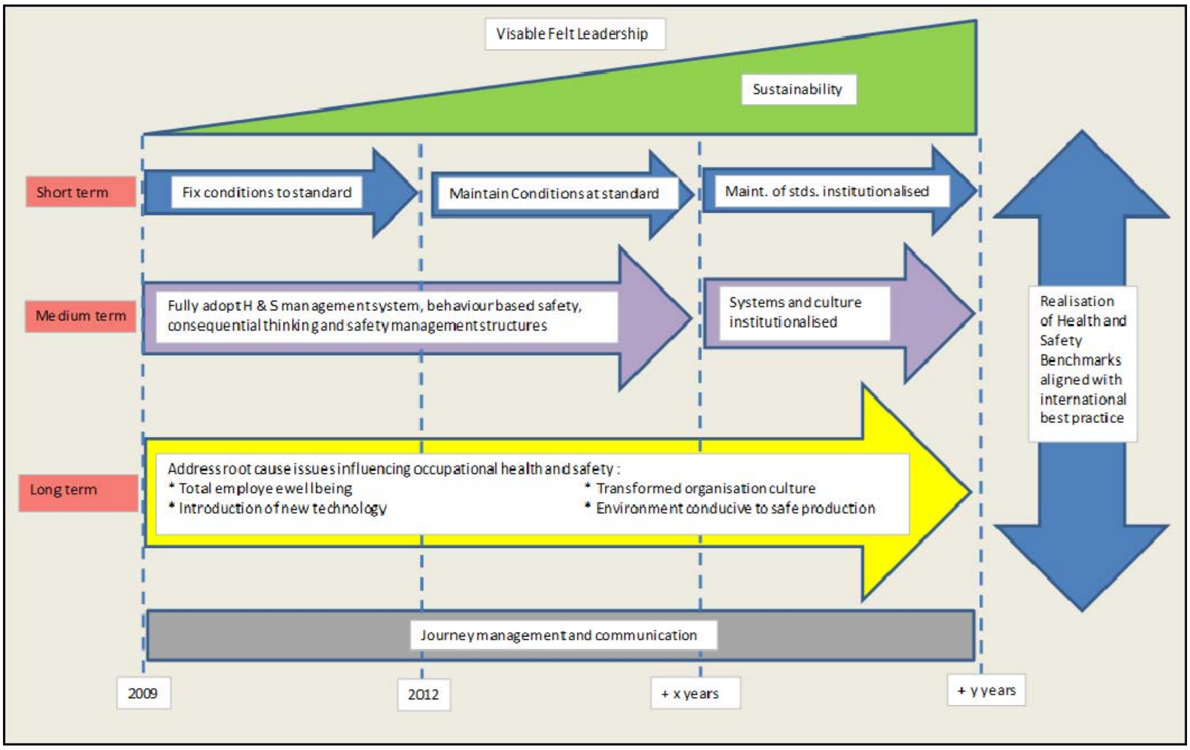
Metorex conducted a full independent survey of safety, health, environment and community ("**SHEC**") issues in June 2009 and the following conclusions were made:

- Adequate SHEC resources were not available on sites or if available were not used correctly;
- There was an absence of a clear SHEC strategy on corporate and operational levels;
- Operations would not reach a point of SHEC management excellence as there was a lack of understanding of the risks pertaining to the operations and the consequences thereof. There was a lack of consequential thinking on all organisational levels of all operations assessed;
- The organisations risks were not well covered or understood;
- The organisation needed to define directive strategies, implement a SHEC system and conduct a SHEC base line risk assessment to assist in focussing activities.

It was predicted that by following this path and implementing international best practice, a sustainable SHEC performance would be possible within 3 years.

Strategy Roadmap

To achieve high levels of health and safety performance, Metorex developed a health and safety strategy that would follow a systematic approach (Figure 3.29).



srk consulting	**Metorex** Metorex's Strategy roadmap for implementation of Health and Safety	Project No. 453459

Figure 3.29: Metorex's Strategy roadmap for implementation of Health and Safety

The roadmap aimed firstly at achieving rapid improvement in health and safety performance through short term measures which focused attention on physical conditions at the mine. To promote sustainability of the improvement thus achieved, Metorex has placed a focus on full application of the health and safety management system across each mine and instilling in parallel a behaviour based safety culture amongst the workforce. These two components have been incorporated into an overall SHEC initiative of visible felt leadership that is aimed at institutionalising safety excellence in the workplace and creating a workplace culture that is supported by systems, processes and structures that are integral to normal operations.

Safety Management Practice

Following the 2009 audit, Metorex established a more comprehensive process for safety management based on a risk management framework. The current safety management practice is designed around five key elements, as follows:

1. identify hazards, assess risks and institute remedial action;
2. establish procedures and standards that reduce risk to tolerable levels;
3. train employees in correct use of the procedures and standards;
4. supply resources required for employees to implement procedures and standards; and
5. monitor compliance to procedures and standards.

This process is applied on a mine-wide basis to develop generic mine standards, and at an individual workplace level to determine special methods and precautions that must be adopted. It is configured as a continuous improvement cycle so that new learning derived from incidents is incorporated into updating of procedures and standards. Risk mitigation measures are selected through evaluation of what is reasonably practicable in the context of the assessed risk level.

Lack of compliance with standards and procedures was clearly recognised by Metorex in 2009 as a major issue, with the most pressing issues related to:

- Shortage of the resources, including people, equipment and materials, required by mining crews to engage in safe production, which is exacerbated by a shortage of experienced and well qualified mining and engineering supervisors and managers.
- There is a cultural tolerance to risk in the developing countries in which Metorex operates that is considered unacceptable in first world countries.
- The "Stop, Think, Fix and Continue" approach should be enforced more rigorously by supervision.
- There is a need for continuous re-evaluation of site specific risk and mitigation measures in response to changes in conditions or deviations from the mining plan. Change management is an intensive process that is often not conducted adequately as the required specialised skills are scarce.
- An increased focus is required on elimination of "at risk" behaviour. An unwritten ground rule that "at risk" behaviour is regarded as unacceptable needs to be established as the norm in the workplace.

SRK is satisfied that Metorex has introduced policies and procedures that have addressed the issues outlined in 2009 and listed above. All of the highlighted issues have now been addressed.

Minimum standards and requirements

Metorex's policy has set minimum standards and requirements for the different SHEC components to be applied at each mine, as follows:

- **Safety** – formal reviews of a health and safety policy (annually), base line risk assessment and occupational base line risk assessment (at least every 3 years), and standards and procedures (every 3 years); maintain systems of measurement and continuous risk assessment on all tasks, investigate all incidents; have a comprehensive emergency plan;
- **Training** – to cover at least induction, and training for specific tasks, policy and procedures, specialised interventions and SHEC system;
- **Leading indicators** – mines are required to report monthly and quarterly on *inter alia* work place audits, incident investigations, reported hazards, planned task observations, medicals and occupational hygiene measurements;

- **Lagging indicators** – required to measure and report on *inter alia* incidents, accidents, fatalities, lost time accidents, reportable accidents, and present the rate per million man hours worked; also clinic/hospital visits and medical cases (TB, HIV/Aids, STD and silicosis);
- **Reporting** – communication and feedback is a vital part of Metorex's SHEC system, and mandatory reports are required to be submitted weekly, monthly, quarterly and annually;
- **Meetings** – to facilitate communication and feedback, mandatory meetings are to be held at each mine on a daily, weekly, monthly and quarterly basis;
- **Systems** – Metorex uses the Isometrix SHEC system for recording all safety and health issues.

Targets – objectives for health and safety performance

Metorex has established "Zero Harm" as a critical objective in realising its vision, so that no-one is hurt or harmed (safety), no ill health is caused because of an individual's work (occupational health) and exposure to conditions or toxins (illness). Unfortunately a fatality was recorded in March 2013, as follows:

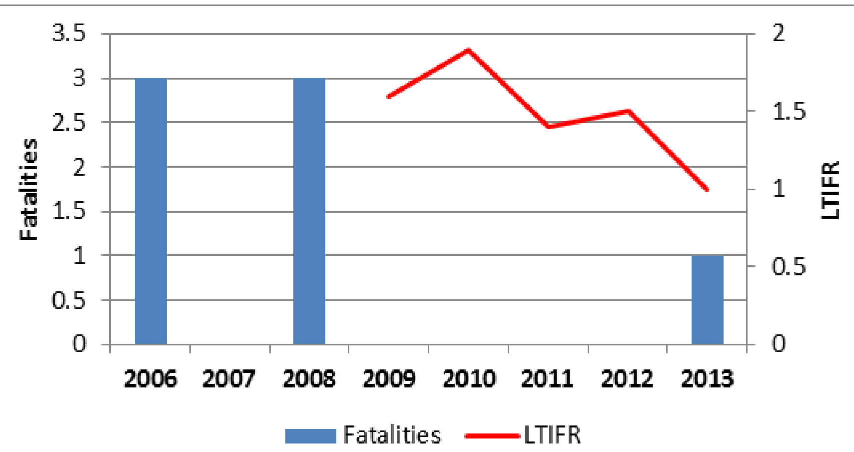
***Fatality description**:*

6 March; In the south west corner of the ASFD project site a Hydra mobile articulated crane belonging to Mining Chemical Services (MCS) transporting a cable drum with gross weight of 5,222kg toppled over and the boom struck and fatally injured an African Mechanical Superlift Limited (AMSL) employee, Mr. Manjunath, and narrowly missed Mr. Suresh Kumar, also from AMSL, who was standing alongside the deceased. Mr. Mwenze Kino, the Hydra crane operator was admitted to the Don Bosco Hospital in Lubumbashi for observation for trauma / shock following the accident. He was admitted to hospital under police custody. His condition was monitored by the Ruashi Mining CMO, Dr Nowa Mutangala, and regular updates were provided. He was discharged from hospital on the morning of 8 March 2013 having suffered no injuries. Mr Kino has since returned to work with Somika.

3.15.2 Historical Trends in Health and Safety (All operations)

From the implementation of the SHEC Policy in 2009 up to June 2013, one fatality had been reported at Metorex's operations, with a fatality occurring at Ruashi Mine in March this year. This is a marked improvement on the six fatal accidents reported between 2006 and 2008, as shown in Figure 3.30.

The lost time injury frequency rate ("**LTIFR**") is an internationally recognised benchmark for measuring the effectiveness of a health and safety programme, where a LTIFR of 1.0 per million manhours worked is considered as the benchmark rate. The LTIFR for 2009 to 2012 for all Metorex operations is shown in Figure 3.30. The LTIFR was not recorded on a routine basis prior to 2009.

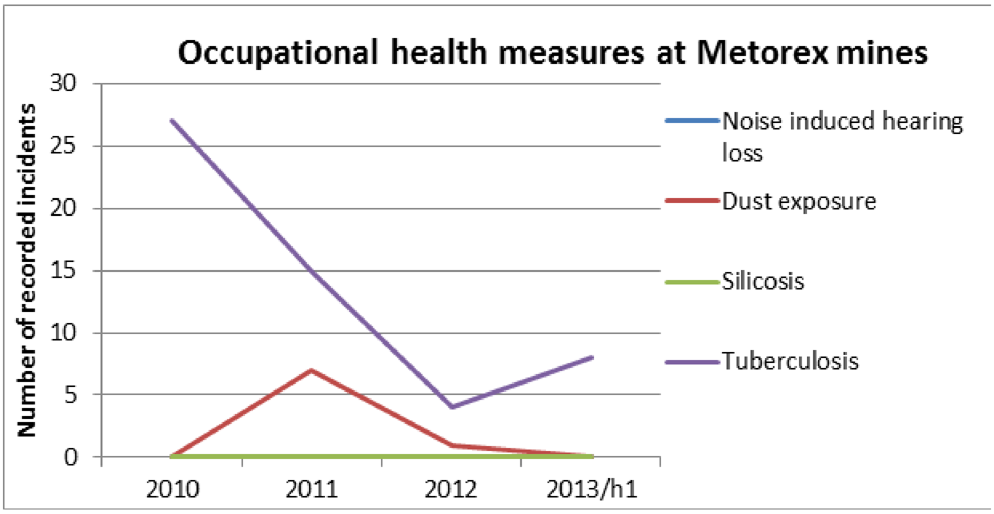


srk consulting	**Metorex** Number of fatalities and trend in LTIFR at all operations 2006 to June 2013	Project No. 453459

Figure 3.30: Metorex – Number of fatalities at all operations 2006 to June 2013

The trend in key indicators relating to occupational health issues for the period 2010 to June 2013 is shown in Figure 3.31. It should be noted that data for prior years is not available for comparison due to a lack of consistent recording.

From the historical trends, Metorex has in general improved its safety performance across its operations in recent years. From Figure 3.31, the incidence of noise induced hearing loss and tuberculosis has reduced considerably from 2010 to 2013.



srk consulting | **Metorex** Trend in occupational health related indicators for all operations 2010 to June 2013 | Project No. 453459

Figure 3.31: Metorex – Trend in occupational health related indicators for all operations 2010 to 2013

3.15.3 Quarterly SHEC Reports

Safety

To gauge how successfully the SHEC policy these and systems have been implemented, the safety performance statistics for the Ruashi Mine for F2010 to H1-F2013 are shown in Table 3.31.

Table 3.31: Ruashi Mine – Safety Indicator Statistics F2010 to H1-F2013

Safety indicator	Total F2010	Total F2011	Total F2012	Total H1-F2013
PTO	338	717	1124	597
NLTI	182	41	37	14
LTI	7	3	4	0
TRI	188	44	41	14
RI	3	2	2	1
LD	76	28	193	181
F	0	0	0	1
LTIFR (No/mmh)	1.9	0.7	0.9	0.0

Legend to safety indicator descriptions:

PTO planned task observations carried out;
NLTI non-lost time injuries (accidents);
LTI lost time injuries;
TRI total recordable injuries;
RI reportable injuries (>14 days off work);
LD lost days due to accidents, not able to return to work
F fatality

Inspection of Table 3.31 shows that the lost time injuries for H1-F2013 have decreased since F2010. There have been no lost time injuries in H1-F2013. The significant increase in the number of lost days in F2012 relative to F2011 is due to a particularly serious injury where the individual was off work for a number of months before being able to return to normal duty.

Although Metorex reports a significant improvement since the implementation of the Metorex health and safety system and health and safety plan, the number of LTIs per year appears to have plateaued. This tends to suggest that there could be a behavioural issue that is impacting on safety performance, the "cultural tolerance to risk" mentioned above.

From a review of the Q3 and Q4 SHEC reports of F2012 and Q1 / Q2 SHEC reports of F2013 for the Ruashi Mine, SRK noted the following points:

- Ruashi achieved its 3 millionth fatality free shift in September 2012, which is a commendable achievement;
- The mosquito control program, has improved the situation regarding the number of malaria cases reported, as a result on the mine supplying mosquito nets and mosquito repellent to workers, unfortunately the Fatality recorded in March 2013 has undermined this performance;
- There have been a number of acid spills in the processing plants, with 20 strong acid spills reported in F2012 and 8 strong acid spills already reported in H1-F2013. SRK is concerned that this is a trend that needs to be reversed to ensure the safety of operators in the future;
- The alcohol testing of employees on a random basis reported 11 cases in the last six months of F2012. All test failures have been followed up with disciplinary action. A zero tolerance approach has been adopted by the mine, which SRK supports fully;
- The process plant has been fitted with 25 safety showers to allow prompt washing down if a worker is contaminated with any volatile substances;
- There has been a high level of violence in the community resulting in 12 workers at the mine getting injured. Efforts are underway to curb this development;
- Fly rock damage to dwellings has been reported and confirmed to dwellings adjacent to pit 3. This issue is planned to be addressed in F2013.

Health

Although the number of clinic visits and malaria cases decreased year on year, the number of days lost to sickness increased by 20% (Table 3.32). SRK understands that Metorex has made this a key performance indicator (KPI), to actively try and reduce the number of days lost due to sickness by implementing various wellness initiatives.

Community

There had been an increase in community incidents at the Ruashi Mine during F2012. The community was more volatile in Q4 of F2012, which Metorex believed was due to a large influx of people from other regions.

Table 3.32: Ruashi Mine – Health Indicator Statistics 2011 to 2013

Safety indicator	Total F2011	F2012					F2013		
		Q1	Q2	Q3	Q4	Total	Q1	Q2	Total
Medical Examinations	15 990	3 052	3 441	3 102	3 085	12 680	3332	3372	6704
Sick Leave Days	1 275	495	492	165	243	1 395	490	350	840
New TB cases	0	0	0	0	0	0	1	1	2
New HIV/Aids cases	38	5	8	2	0	15	0	1	1
VCT		190	180	296	180	806	262	550	812
Malaria cases	1 735	411	398	298	286	1 393	299	282	581

3.15.4 Site visit observations – Ruashi Mine

Few safety and health issues were seen on the site visit to the Ruashi Mine. The equipment generally appeared to be well maintained and the planning department confirmed this when high plant/equipment availabilities were reported and presented.

The following safety and health issues were seen during the visit:

- The electro-winning area has inherent gas health risks associated with the acids used in the process. It also carries safety risks associated with acid burns. Despite this, workers were seen not to be wearing the proper personal protective equipment ("**PPE**"), particularly the full face respirators and safety glasses/hoods.
- The plate lifting beam used to lift the copper electrodes out of the acid baths was seen to be defective. Its lifting lug securing bolts were extremely loose and there was a risk of the plates falling back into the baths

and splashing the operators. The operators did not seem to understand that the loose lifting beam anchors represented a serious risk to their well-being. This tends to suggest that the team was not aware of all the risks present in their work stations. Also, this defect should, for example, have been picked up as part of a start of shift inspection.

3.15.5 SRK Comments

Generally, the Ruashi Miine has performed well, with the total reportable injuries for F2012 generally better than the performance in the previous year and zero reportable injuries for H1-F2013. Unfortunately the improving performance has been affected by the recent unfortunate fatality in March 2013. The deterioration in the lost days (LD) was due to a person whose injuries required he be off work for a number of months before he could return to his normal work. One of the serious accidents occurred when two contractors started working on a pipe filled with acid despite being told not to work on the pipes until the supervisor was present. This resulted in one of the contractors sustaining serious acid burns and the other sustaining less serious burns when he rescued his colleague from the dangerous situation.

The safety statistics now reflect the standards of safety, maintenance, repairs and operations seen on site at the Ruashi Mine operations. Given the observations made by SRK during its visit in the EW section, it does tend to suggest that there is a worker behavioural issue here - the operators were not aware of the risks present with the electrode lifting beam. The fact that the defect had not been reported to the maintenance department tends to confirm this. The level of lost time accidents and non-lost time accidents are low, compared to other world class operations.

SRK recommends that management concentrate their efforts on employees' behavioural aspects towards safety and health in the work place. This needs to include more safety awareness and risk awareness in the work place. This particular aspect could in future form part of the work based auditing and planned task observation processes currently carried out by management and supervisors.

SRK has been appraised by Metorex that policies and management systems to educate employees on workplace health and safety have been put in place.

There is no law requiring Metorex to report OHS statistics with the financial results.

3.16 Environmental Studies, Permitting and Social Impact

[SR5.2(B/C)]

Discussions were held with Mr Phil Wright (SHEC Manager), Mr Yvon Kusongo (Environmental Officer) and Elisa Kalasa (Social Manager) during the visit to the Ruashi Mine. Subsequent to the site visit, a telephonic discussion was held with Ms Colleen Perkins of Metorex.

3.16.1 Introduction and Regional Setting

The Ruashi township, adjacent to the Ruashi Mine, has encroached very close to the open pit and pedestrian traffic over the concession area occurs. The township is a peri-urban settlement within Lubumbashi, the capital of Katanga province. Subsistence farming is a significant land use and there is no commercial agriculture or forestry. Allocation of land is undertaken by the Ruashi mayoral office (elected officials) and traditional leadership is relatively insignificant. At the time that the Environmental and Social Impact Assessment ("**ESIA**") was compiled, artisanal mining was taking place on the concession, but this situation has been resolved in terms of a formal process. The area is in need of development, with electricity, water and sanitation being significant priorities in terms of a survey conducted for the ESIA.

There were mining operations in the area prior to the involvement of Metorex, with an old open pit and tailings dam on the site.

The mine is situated on a watershed between two tributaries of the Lualaba River. Hence major water courses are not an issue with respect to the operation, with only the headwaters of streams within the borders of the mining concession, limiting the volume of runoff over the disturbed area.

Apart from the issues related to pollution as a result of the operation, with air, water and soil quality likely to be the most significant concerns and the reduction in terms of land use capability, incremental biophysical impacts are limited by the existing disturbance in the area, as a result of both previous mining operations and community pressures.

3.16.2 Project Description

Open pit mining, using drill and blast is carried out with three pits on a total footprint area exceeding 100 ha, with an overburden dump area of some 95 ha. The foot print of the plant area is approximately 16 ha.

Tailings are disposed of on a conventional ring dyke tailings dam with a footprint of some 80 ha. The side slopes have been successfully grassed using a local stolineferous grass.

Current water management practices include the application of traditional storm water management principles, monitoring, and corrective action as necessary.

3.16.3 Pontential Material Environmental Risks

The Equator Principles audit undertaken in 2011 identified the management of ground and surface water resources as the key environmental challenge facing the Ruashi Mine. The audit was repeated in 2012 but this conclusion remains applicable, and also reflects SRK's view, although it is noted that significant progress has been made in addressing issues from the 2011 audit. This issue is addressed in Section 3.8 of the CPVR.

As an operational control measure to address deteriorating pH levels in ground and surface water which potentially represent a long term liability, the mine has drilled a fence of drill holes around the TSF and equipped these with pumps to pump the low pH water back to the TSF for neutralisation with lime. Since the site visit by SRK, on-going monitoring of water quality has continued. Data obtained in this way will assist in obtaining a better understanding of the potential impacts associated with ground water and possible long term liabilities.

Metorex has in this respect increased a group wide provision for water treatment as discussed under the heading "Financial Provision" below. It cannot be guaranteed that this provision will eliminate this risk but it reduces the financial impact significantly.

3.16.4 General Observations Regarding Environmental Management

The following general observations are made, based on the review of reports made available, including Equator Principles Audits undertaken in 2011 and 2012:

- Negative biophysical impacts of the project were predicted to be generally moderate. Parts of the Concession Area have been directly impacted by past mining, notably the old Ruashi Mine pit with its associated stockpiles and tailings which constitute the project resource. Where mining has not occurred, urbanisation and subsistence, slash-and-burn agriculture has extensively transformed natural habitats, leaving little trace of intact habitat with some conservation value.
- Air quality impacts from the plant were predicted to be minimal, due to the adoption of strict design standards for emissions. Management and ongoing rehabilitation of exposed surfaces of the new tailings disposal facility were proposed in the ESIA to limit dust generation during the operating and post-closure phases. Observations on site suggest that this is occurring or can be achieved using well understood management measures. The control of both gaseous emissions and dust are, however, a function of the effectiveness of management measures, and the effectiveness of air pollution control measures at the plant could be called into question. It was noted at the time of the site visit that an acid plant was to be commissioned and it has been subsequently reported that this has been done. No in-stack monitoring results were made available to quantify atmospheric emissions, but a survey is planned.
- Expansions to the mine (construction of acid plant and spin flash dyer) are envisaged which are not included in the existing ESIA for Phase 2. No information was provided as to whether an ESIA has been done for this expansion. It is SRK's view that corrective action in this respect should not be problematic. Metorex reports that these projects have been included in an updated EIA/EMP according to DRC requirements and that this document has been approved.
- Topsoil has not been stockpiled for rehabilitation purposes. SRK was advised during the site visit that some overburden piles contain some topsoil. Metorex reports that no topsoil had been stockpiled for future rehabilitation as a result of previous historical mining carried out by Gecamines and artisanal mining prior to Moterex acquiring its shareholding.
- The mine has recognised waste disposal as an issue and has constructed a domestic waste site which is secured and managed properly. At the time of the site visit there was evidence of sound construction and improved waste management.

- Storage of hazardous chemicals was seen as an area where improvement was needed in terms of Equator Principles. Metorex maintains that adequate protection against spillage is in place and there is no material risk associated with the storage of these chemicals. SRK understands used oil is removed under contract
- More formalization of systems, is recommended in the 2012 Equator Principles Audit, noting that the mine is committed to IS14001 certification by the end of 2014

3.16.5 Potential Material Social Risks

Social Issues and, in particular, resettlement requirements, have been a significant area of concern for the operation. The Equator Principles audit undertaken in 2011 identified the proximity of the surrounding communities as the key social challenge facing Ruashi Mine. At the time of the site visit it was reported that the situation regarding social problems and the implementation of the Resettlement Action Plan ("RAP") has improved. Metorex acknowledged that by virtue of the proximity of the community to the mine and the inherent volatility of communities in an African context, community dissatisfaction and possible unrest represented a potential risk (for example unrealistic expectations with regard to post closure supply of services such as water) to the operation. This finding is exacerbated by the observation in the social scan report that community representation on the Community Liaison committee seems to be slanted towards government functionaries. Discussion on site during the site visit did not provide comfort that this may not still be the case, although the 2012 Q3 SHEC report notes that the Pit III Compensation has been completed and some USD2 million approved for compensation. The Equator Principles audit for 2012 confirms that RAP requirements and compensation payments are adequately implemented.

Concern regarding representation and possible community volatility is noted as issues that need to be taken into account. It should be noted that most of these issues are related to factors beyond the control of Ruashi and Metorex. This does not reduce the potential volatility.

3.16.6 General Observations Regarding Social Considerations

General conclusions from the socio-economic impact assessment, as recorded in documentation reviewed and site observations include the following:

- Relatively few impacts were regarded as high. In general, the mine was not seen as a high impact.
- Community members using pathways across the mine area represent a risk in this regard and the mine has constructed walls to address this problem, with some success. During the site visit it was noted that the movement of people across the mining area is still significant.
- Water from the Fish Dam, which has been contaminated as a result of the low pH ground water plume from the tailings dam daylighting in the dam, is used by the local communities. The water quality is such that this potentially poses a health risk.
- At the time of the site visit there were still outstanding grievances from the relocation programme that was required for mine development, and further relocation was required in the vicinity of Pit III. However, the October 2012 monthly report notes that the demarcation boundary limit process in the Ruashi Mine community area is progressing well and Metorex has subsequently reported that all of the grievances related to the initial resettlement process had been resolved.
- Community farming projects have been initiated in response to the government requirement that such projects be undertaken.
- Mines in the DRC area expected to establish 500 ha of maize production. Ruashi Mine is doing this in conjunction with Kinsenda and the process seems to be going well.
- Metorex reported that there are no land claims over Metorex mining properties and also that although the influx of people onto the mine lease area is, in strict terms, illegal, it is nonetheless sanctioned by the authorities.
- Metorex has reported that the closure and retrenchment process is incorporated into the closure plan linked to the life of mine plan. Metorex does not envisage closure prior to the end of the LoM and therefore immediate mass retrenchment and other social impacts are not a risk in management's view.
- In discussing the key social issues, or challenges faced by the mine, the social scan report has identified the following, amongst others:
    - Significant levels of poverty in the area.

- Overall poor quality of basic infrastructure in communities.
- Low level of government and community capacity (staffing and other resources).
- Insufficient level and coordination of government development planning.
- High levels of corruption.
- High community expectations. Historical memories of the paternalistic nature of how Gécamines used to operate in the area.
- The challenge for government of trying to address key issues whilst trying to manage community expectations and demands.
- A neighbouring mining company (Chemaf) that, according to information provided to rePlan, is not well regarded by government and communities and that has not performed well on the social front.
- Increasing government scrutiny of mining companies and their contribution.

The mine is involved in several Corporate Social Responsibility projects in the areas of education, health, infrastructure, potable water and power. These projects, which are co-ordinated by a committee on which the mine, the mayoral office, the water and electricity utilities and local chiefs are represented, are continuing. The Q3 SHEC report notes completion of a library for use by the community in co-operation with the DRC and Belgium governments

3.16.7 Legal Compliance

The mine is operating in terms of an ESIA compiled according to international requirements and other permits in terms of DRC legislation are in place. Expansions to the mine (construction of the acid plant and spin flash dryer) have been included in an updated and approved EIA/EMP according to DRC requirements, and have been approved by the relevant authorities

It is SRK's view that, provided the mine adheres to the remedial measures and obligations of the ESIA, there should be no reason that would prevent the mining licence from being renewed. This does not constitute a legal review and SRK does not make any claim or state any opinion as to the ability of the mine to obtain or renew the necessary permits. It must also be noted that this view by SRK does not imply that the mine is in strict compliance with all the requirements of the ESIA or other permits.

It was reported during the site visit that both the national and provincial environmental authorities visit the mine but that they had not raised any issues with long term implications. Metorex has confirmed that external audits undertaken every two years have been approved by the authorities.

3.16.8 Mine Closure Planning and Financial Provision

The mine has had its closure costs estimated by a professional valuation surveyor. SRK has reviewed the list of items set out in the closure assessment and considers that there may be some possible omissions. These include:

- The need for ongoing water treatment following closure;
- Provision for the rehabilitation of the tailings dam;
- Adequate provision for re-profiling of the dumps. It is possible that this is seen as being undertaken using operational budgets, as was observed on the site visit;
- Provision for soil contamination remediation.

In terms of the first of these omissions, it is significant that measures to address the contamination of both ground and surface water quality attributed to the plume migration from the tailings dam depend on on-going treatment of the water with lime and the use of scavenger drill holes. These are operational measures which will, unless replaced by passive measures, require an on-going presence at the mine following cessation of operations. Interpretation of on-going water monitoring results will assist in the investigative work required to assess the likelihood of the post closure water treatment being required.

There has been no backfilling of the pit to date and rehabilitation of the overburden dumps will be required. Plans are in place to deposit overburden from Pits II and III into Pit I when mine scheduling allows for this, potentially reducing the rehabilitation liability. The slopes of existing overburden dumps have been flattened to facilitate rehabilitation in certain areas and this activity will greatly enhance the success of the rehabilitation programme. Disposal of future overburden in Pit I will limit the extent to which an increase in the overall dump footprint will be required for the flattening of the slopes.

Against this background the closure cost estimate determined by Steadman amounts to a sum of USD16.7 million. This figure includes a contingency of 20% and assumes that the work is carried out in house or directly sub-contracted. It is based on an estimate compiled in 2010 and escalated to 2011 at an assumed inflation rate of 10%. Including provisions for the rehabilitation of the tailings dam and the remediation of contaminated soils and escalating the estimate by a further 10% to be valid for 2012 yields a closure cost estimate of USD19.9 million. If it is not possible to do the work in house and assuming a further 30% increase to allow for a management contract, the figure increases to USD25.9 million. This latter figure has been accepted for evaluation purposes.

SRK has reviewed and modified a previous closure assessment for inclusion in the present evaluation, which is normal practice. SRK believes that the provision is sufficient for this purpose.

In terms of possible water treatment Metorex has a group-wide provision for post-closure water treatment of around USD5 million. In SRK's experience, this figure is likely to be considerably more. In the absence of any proper evaluation of the extent (quantities) and severity (pH or TDS) of water to be treated, SRK has in agreement with Metorex for evaluation purposes increased this provision for post closure water treatment to USD25 million for the group, of which USD10 million has been allocated to Ruashi. It should be noted that this provision does not eliminate this risk, but it reduces the potential financial impact on the company significantly. This provision increases the total closure cost estimate for Ruashi to USD35.9 million.

The mine has budgeted for a closure plan to be compiled in F2013. If due process is followed for this purpose, and appropriate investigative work undertaken, the plan will address some of the concerns relating to Equator Principle compliance and lead to a more accurate assessment of the closure cost.

3.17 Material Contracts

3.17.1 Off-take Agreements

[SR5.8]

Copper production is sold via two off-take agreements with Glencore International AG ("**Glencore**") and MRI Trading AG ("**MRI**"), while cobalt is purchased by Lanzhou Jinchuan Advanced Material Technology Co., Ltd. (**"Lanzhou Jinchuan")** a subsidiary of Jinchuan Group co., Ltd. (**"Jinchuan").**

- **Glencore** – the contract runs from January to December 2013 and can be extended by mutual agreement. Glencore is entitled to purchase a minimum of 50% of the annual Cu production of Ruashi Mine as London Metal Bulletin ("**LME**") Grade A copper cathode. Three different grades of copper cathode are defined, dependent on the Cu content and content of impurities relative to the LME limit. The price payable for the LME Grade A cathode is set at the LME cash settlement price plus the official long term contract premium as announced annually by Codelco. If the Cu cathode does not meet the LME Grade A cathode quality requirements, penalties as a discount on the LME cash settlement price will be levied. The cost of delivery, clearing, freight and insurance is for the account of Ruashi Mining.
- **MRI** - the contract runs from January to December 2013 and can be extended by mutual agreement. MRI is entitled to purchase 50% of the annual Cu production of Ruashi Mine as London Metal Bulletin ("**LME**") Grade A copper cathode up to a maximum of 15 kt in the calendar year. MRI will only accept LME Grade A cathode. The price payable for the LME Grade A cathode is set at the LME cash settlement price plus a defined premium per tonne. If the Cu cathode does not meet the LME Grade A cathode quality requirements, penalties as a discount on the LME cash settlement price will be levied. The cost of delivery, clearing, freight and insurance is for the account of Ruashi Mining.
- **Lanzhou Jinchuan** – all cobalt production in terms of a LoM off-take agreement used to be sold to Jinchuan Group Company Ltd. This was amended in terms of a Memorandum of Understanding ("**MoU**") in February 2011 in terms of which all cobalt would be sold to Lanzhou Jinchaun, a another company owned by Jinchuan. An agreement incorporating the terms of the MoU still has to be signed and then the contract will be novated from Jinchuan to Lanzhou Jinchuan. The price payable is linked to the LME Co price, adjusted by a payability factor which takes into account that the final product is a salt and still needs further refining. The payability is adjusted depending on the moisture content in the salt.

3.17.2 Power Supply

Ruashi is supplied with power from three fixed-line sources, SNEL (10 – 12 MW between 22h00 and 06h00), CEC (up to 8 MW between 06h00 and 18h00) and ZESCO (8 MW between 22h00 and 06h00).

- **SNEL** – electrical energy is to be provided with 3-phase 50 Hz alternating current at a nominal voltage of 220 kV or 120 kV. The supply agreement provided for the subscribed demand to increase in a step-wise fashion from 9 MW (2007) to 18 MW (Q1 2008) to 36 MW from April 2008 onwards and would remain in force for 15 years (until 2022). Ruashi Mining has to notify SNEL each year of its projected energy requirements for the next 5-year period. If SNEL is unable to meet the notified 5-year power demand, Ruashi Mining is "free to supply his demand from his own generation". The agreement allows SNEL to interrupt supply to carry out maintenance and emergency repairs, up to a maximum of 10 hours per calendar year. The price payable is made up of two components, a demand fee and a usage fee, which are adjusted annually by a factor linked to consumer price index ("**CPI**") in October of each year as published by the US Department of Economic Affairs. A sliding scale of penalties applies when the power factor drops below 90%. Similarly, a sliding scale of penalties, which acts as a discount to the invoiced amount, is based on the aggregate supply interruptions recorded during any month. In return for the financing of an upgrade to the Karavia substation, a discount on monthly invoices would apply until the invested amount and accumulated interests are repaid in full.

SRK has not seen the energy supply agreements with CEC and ZESCO, but understands that the terms of the agreements are similar to those of SNEL.

3.17.3 Mining Contract

[SR5.6]

MCK is a well-established contractor in the DRC and Ruashi Mining is one of its largest customers. MCK performs contract mining services Kinsevere (MMG), Etoile (Chemaf) and is in the process of securing the mining contract at Frontier (ENRC). MCK was selected as Ruashi'scontract miner approximately 5 years ago after a tender process. The contract was renegotiated in 2011. The mining contract has a rise and fall formula which ensures that MCK's rates are constantly adjusted for the effects of inflation. This reduces the financial risk to MCK and improves its overall sustainability as a contract miner.

There are a number of contract mining companies in Southern Africa and these could be approached if MCK were to cease operating. Ruashi Mining could also take on the mining function itself.

3.18 Financial Model Summary

[SR5.7, SR5.8]

The key TEPs from the FM for Ruashi Mine based on the approved LoM plan are summarised in this section.

3.18.1 Financial / Economic Criteria

Incorporated into the FM for Ruashi Mine are the following financial / technical / economic criteria:

- There are no hedging contracts in place;
- Depreciation allowance for tax purposes is 60% of capital expenditure in a given year plus 15% of the accumulated unredeemed capital expenditure, which excludes the 40% of that year's capital spent;
- Ruashi Mine receives a premium of USD80/t above the ruling Cu price on the London Metal Exchange for its Cu cathode;
- Metallurgical recoveries for Cu and Co are set at 85% and 71% for H2-F2013 respectively, and are kept at these levels for the LoM. The 85% Cu recovery used in the forecasts is lower than was achieved in F2012 and H1-F2013, since the longer residence time in the leach circuits due to reduced plant throughput rates will no longer be possible. If the low Co recovery in March 2013 is excluded, Ruashi exceeded the target Co recovery in H1-F2013;
- The payability of Co salts to Ruashi Mine is only 68% in H1-F2013. This is increased to 69.3% in H2-F2013 and 69.5% in F2014 once all spin flash driers are commissioned and the moisture in the Co salt is reduced;
- The revised contract terms for export / clearing of the Cu and Co final products are applied with effect from 1 January 2013;

- Terminal benefits based on a 6-month provision at end of LoM;
- SRK has included the additional capital costs for truck despatch system (USD1 million) and USD 4.5 million for relining of RWDs and installation of penstock sleeves.

3.18.2 Financial model summary

The key TEPs for the revised LoM FM for Ruashi Mine are summarised in Table 3.33.

The production schedule is as provided by Metorex and audited by SRK.

The process recoveries are supported by historical performance, metallurgical testwork and plant upgrade projects.

The cost components for Ruashi Mine are based on the strategic business plans and detailed one-year budgets as compiled by Metorex. SRK has reviewed these costs for reasonableness in relation to the actual costs incurred in F2012 and H1-F2013. Where deemed necessary, SRK has adjusted the forecast costs as used in the financial models.

The capital expenditures are as per the detailed budgets and forecasts supplied by Metorex and reviewed by SRK. Based on its review, SRK has added capital amounts as deemed necessary.

SRK reviewed the terms of the off-take agreements and confirmed these were correctly incorporated into the Ruashi Mine LoM FM.

Table 3.33: Ruashi Mine – summary of post-tax pre-finance cash flow model

Item	Units	Totals/ Averages	H2-F2013	F2014	F2015	F2016	F2017	F2018	F2019	F2020	F2021	F2022
Production												
ROM mined	(kt)	12 103	1 065	2 525	1 565	899	1 961	2 016	35	2 038		
Waste mined	(kt)	74 327	4 203	8 536	10 374	11 090	10 092	8 810	11 548	9 673		
Ore milled	(kt)	13 057	704	1 409	1 437	1 417	1 413	1 413	1 413	1 417	1 460	975
Cu feed grade	(%)	2.68%	3.23%	3.24%	3.22%	3.20%	3.22%	3.18%	2.46%	3.05%	1.09%	0.50%
Co feed grade	(%)	0.45%	0.37%	0.37%	0.45%	0.53%	0.50%	0.35%	0.36%	0.41%	0.46%	0.79%
Total contained Cu	(kt)	349.4	22.8	45.7	46.3	45.4	45.5	45.0	34.8	43.2	15.9	4.9
Total contained Co	(kt)	59.3	2.6	5.2	6.5	7.6	7.1	5.0	5.0	5.8	6.7	7.7
Processing												
Metallurgical recovery Cu	(%)	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%
Metallurgical recovery Co	(%)	71.0%	71.0%	71.0%	71.0%	71.0%	71.0%	71.0%	71.0%	71.0%	71.0%	71.0%
Payable Cu	(kt)	297.0	19.3	38.9	39.4	38.6	38.7	38.2	29.6	36.7	13.5	4.1
Recovered Co	(kt)	42.1	1.9	3.7	4.6	5.4	5.0	3.5	3.6	4.1	4.8	5.5
Commodity sales												
Cu sales - LME grade	(kt)	297.0	19.3	38.9	39.4	38.6	38.7	38.2	29.6	36.7	13.5	4.1
Co sales	(kt)	42.1	1.9	3.7	4.6	5.4	5.0	3.5	3.6	4.1	4.8	5.5
Commodity prices												
Average Cu LME	(USD/t)	8 171	8 171	8 171	8 171	8 171	8 171	8 171	8 171	8 171	8 171	8 171
Premium to LME	(USD/t)	80	80	80	80	80	80	80	80	80	80	80
Average Co MB	(USD/lb)	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
Payability	(%)		69.3%	69.5%	69.5%	69.5%	69.5%	69.5%	69.5%	69.5%	69.5%	69.5%
Revenue Real	(USDm)	**3 404.7**	201.2	405.4	429.0	440.1	433.3	395.6	325.5	396.7	219.4	158.5
Copper sales	(USDm)	2 450.5	159.6	320.7	324.7	318.3	319.2	315.5	244.1	303.2	111.2	34.1
Cobalt sales	(USDm)	945.3	41.6	83.7	103.3	120.8	113.1	79.1	80.4	92.5	107.3	123.4
Net revenue from acid sales	(USDm)	9.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operating expenditure	**(USDm)**	**(2 103.4)**	**(129.1)**	**(258.6)**	**(252.7)**	**(261.3)**	**(257.1)**	**(237.2)**	**(204.9)**	**(234.6)**	**(127.5)**	**(140.3)**
Mining (excl salaries)	(USDm)	(279.2)	(12.3)	(39.9)	(40.8)	(39.0)	(38.1)	(35.5)	(36.3)	(37.4)	0.0	0.0
Rehandling cost from stockpile	(USDm)	(26.1)	(1.4)	(2.8)	(2.9)	(2.8)	(2.8)	(2.8)	(2.8)	(2.8)	(2.9)	(2.0)
Processing (excluding salaries)	(USDm)	(796.9)	(55.2)	(104.3)	(99.9)	(104.4)	(102.0)	(90.1)	(67.0)	(81.1)	(51.0)	(41.9)
Engineering (excluding salaries)	(USDm)	(96.3)	(6.1)	(12.2)	(12.6)	(12.5)	(12.4)	(12.0)	(9.5)	(11.7)	(5.0)	(2.4)
Administration (incl salaries)	(USDm)	(474.3)	(30.1)	(58.5)	(53.4)	(52.4)	(52.4)	(52.4)	(52.4)	(52.4)	(39.5)	(30.8)
Environmental / closure	(USDm)	(25.9)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(25.9)
Post closure water treatment	(USDm)	(10.0)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(10.0)
Realisation / off-mine costs	(USDm)	(245.0)	(15.4)	(28.3)	(30.3)	(31.5)	(30.8)	(27.5)	(23.0)	(27.9)	(16.9)	(13.3)
Royalties	(USDm)	(135.2)	(8.6)	(12.7)	(12.9)	(18.8)	(18.5)	(16.9)	(13.9)	(16.9)	(9.4)	(6.8)
Terminal benefits	(USDm)	(14.5)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(4.3)	(2.9)	(7.2)
Operating Profit	**(USDm)**	**1 301.3**	**72.2**	**146.8**	**176.2**	**178.8**	**176.2**	**158.4**	**120.6**	**162.1**	**91.9**	**18.1**

Item	Units	Totals/ Averages	H2-F2013	F2014	F2015	F2016	F2017	F2018	F2019	F2020	F2021	F2022
Capital Expenditure	**(USDm)**	(120.2)	(32.6)	(25.3)	(9.8)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)
New capital	(USDm)	(60.2)	(32.6)	(25.3)	(2.3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sustaining capital	(USDm)	(60.0)	0.0	0.0	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)
Working capital movements	(USDm)	10.7	6.4	(4.0)	(3.1)	(0.2)	(0.2)	(0.8)	(0.9)	0.0	(4.2)	17.8
Company taxation	(USDm)	(329.9)	(6.4)	(39.4)	(49.5)	(49.9)	(50.2)	(45.2)	(30.4)	(45.6)	(13.2)	0.0
Free cash before debt service	**(USDm)**	861.8	39.6	78.0	113.9	121.1	118.2	104.9	81.8	109.0	67.0	28.4
Unit Costs												
On-mine cost	(USD/t milled)	302	277	265	261	280	272	254	302	265	518	1 731
Operating cost per t Cu produced	(USD/t Cu produced)	324	297	285	282	302	294	274	323	286	550	1 805
Op. Cost per t of Cu, net of Co credits	(USD/t Cu produced)	180	199	188	163	160	161	180	200	172	189	449

3.18.3 WACC

The parameters used to generate the WACC for Ruashi Mine are set out in Table 3.34.

Table 3.34: Ruashi Mine – parameters to calculate WACC (for DRC)

Parameter	Value
Un-levered beta (1)	1.42
Re-levered beta	2.23
Market risk premium (2)	5.00%
Company risk premium	11.17%
Risk free rate (3)	2.49%
Country risk premium (4)	6.07%
Cost of equity	19.72%
USD cost of debt (5)	5.68%
Tax rate (average LoM)	30.00%
After tax cost of debt	3.98%

1 This is the median unlevered beta for eight mining companies at June 2013, as extracted from Bloomberg.

2 The market risk premium was based on the 2012 valuation methodology survey conducted by PriceWaterhouse Cooper, and provided by Metorex to SRK.

3 The risk free rate is the rate quoted for United States 10-year government bonds at 30 June 2013.

4 The country rating for the DRC is 30.95 relative to the United States of America given as 75.43, as extracted from http://www.euromoneycountryrisk.com/Home/Return/Countries#ucCountryTable. The country risk premium was calculated as (75.43 / 30.95) x 2.49%.

5 The cost of debt is taken as the 12-month Libor rate at 30 June 2013 of 0.68% plus a 5.00% premium, to convert the Libor rate to an equivalent interest rate in the DRC.

The debt/equity ratios of comparable Chinese resource-based companies listed on the HKSE are set out in Table 3.35. On this basis, a 45 / 55 debt / equity ratio was deemed to be appropriate for Metorex and the Mineral Assets.

Table 3.35: Ruashi Mine – debt/equity ratios for Chinese resource-based companies on HKSE

Company Name	Debt / Equity	Debt
Companies with significant mining assets overseas		
Minmetals Group (MMG) Limited	49 / 51	49
China Nonferrous Mining Corp Limited	41 / 59	41
Aluminium Corporation of China Limited	86 / 14	Excl
Other Comparable companies		
Jiangxi Copper Co Ltd	31 / 69	31
Xinjiang Xinxin Mining Industry Co., Ltd	22 / 78	Excl
Yanzhou Coal Mining Co Ltd	48 / 52	48
CGN Mining Co Ltd	32 / 68	32
Median		45

At a 45 / 55 debt / equity ratio, the parameters in Table 3.34 yield a nominal WACC of 12.64%. The nominal WACC is according to the Capital Asset Pricing Model and is calculated using the formula [55%x cost of equity (= company risk premium (beta x market risk premium) + risk free rate + country risk premium) + 45% x after-tax cost of debt (=USD cost of debt x (1 – company tax rate)]. The effect of inflation is removed and the real WACC calculated using the formula [(1 + rate real) / (1 + inflation) – 1]. Using an indicated 2% inflation rate of the USA (as all TEPs are costed in USD), the real WACC for Ruashi Mine is 10.43%.

3.18.4 Sensitivities

The following tables present the NPVs of the real post-tax pre-finance cash flows as determined from the Ruashi Mine FM using mid-year discounting. In summary they include the following:

- The variation in real NPV with discount factors (Table 3.36);
- The variation in real NPV based on twin (revenue and operating expenditure) sensitivities (Table 3.37);
- The variation in real NPV based on changes to the Cu price (Table 3.38).

Table 3.36: Ruashi Mine – variation in Real NPV with discount factors

Discount rate	NPV (mid-year) (USDm)
6.00%	676.5
7.00%	651.8
8.00%	628.5
9.00%	606.5
10.00%	585.8
10.43%	577.2
11.00%	566.2
12.00%	547.6
13.00%	530.1
15.00%	497.7

Table 3.37: Ruashi Mine – variation in Real NPV based on twin parameter sensitivities

		Revenue Sensitivity						
		70%	80%	90%	100%	110%	120%	130%
Opex Sensitivity	70%	387.1	543.7	698.1	852.5	1 007.0	1 160.2	1 312.7
	80%	295.1	451.9	606.3	760.8	915.2	1 069.6	1 222.4
	90%	202.6	359.9	514.6	669.0	823.4	977.9	1 132.1
	100%	108.0	267.9	422.8	577.2	731.7	886.1	1 040.5
	110%	11.9	174.1	330.9	485.5	639.9	794.3	948.8
	120%	(109.8)	79.3	238.0	393.7	548.1	702.6	857.0
	130%	(238.0)	(18.2)	143.9	301.6	456.4	610.8	765.2

Table 3.38: Ruashi Mine – variation in Real NPV based on Cu price sensitivity

		Copper Price Sensitivity						
Discount Rate	USC/lb	259	297	334	371	408	445	482
	USD/t	5 720	6 537	7 354	8 171	8 988	9 805	10 622
7.00%	67.1%	123.1	303.2	477.7	651.8	825.9	1,000.0	1,174.0
8.00%	76.7%	118.4	292.2	460.6	628.5	796.4	964.4	1,132.3
9.00%	86.3%	114.0	281.8	444.4	606.5	768.7	930.8	1,093.0
10.00%	95.9%	109.7	271.9	429.1	585.8	742.5	899.2	1,055.8
10.43%	100.0%	108.0	267.9	422.8	577.2	731.7	886.1	1,040.5
11.00%	105.5%	105.7	262.6	414.7	566.2	717.7	869.2	1,020.8
12.00%	115.1%	101.9	253.8	401.0	547.6	694.3	841.0	987.6
13.00%	124.6%	98.2	245.4	388.0	530.1	672.1	814.2	956.3
15.00%	143.8%	91.4	229.9	364.1	497.7	631.3	764.8	898.4

3.18.5 Benchmark Costs

In the budget pack for Ruashi Mine for F2013, Metorex had compiled benchmark cost statistics for C1 costs, which include all operating costs required to receive the sales revenue as projected. The C1 cost includes the sum of the following items: mining (waste + ore), processing, site overheads, transportation costs, refining/realisation charges and mineral royalties, but will exclude company taxation, corporate overheads, environmental closure costs, terminal benefits liabilities, financing charges and all non-cash items such as depreciation and amortization. The denominator in the determination of the unit C1 cost is based on the payable unit of metal.

The C1 cost for Ruashi Mine is compared to the benchmarked costs as determined by Metorex in Table 3.39.

Table 3.39: Ruashi Mine – C1 cost benchmarking for F2013

Location	C1 Cost
Worldwide	2 987
Chile	2 826
China	3 038
South Africa	4 931
DR Congo	**3 672**
Zambia	4 582
Ruashi	**3 775**

This shows that the budgeted C1 cost for Ruashi Mine in F2013 is slightly above the average for the copper producers in the DRC.

3.19 Summary of Key Risks

[SV2.10]

A summary of the key risks identified for Ruashi Mine is provided here. Metorex advised SRK that it has a comprehensive risk management process in place which is aimed at identifying and ranking risks across all of the group's operations to determine an overall risk profile for the group. The risks identified by SRK have broadly been incorporated into the overall group risk management process and are being addressed through this.

3.19.1 Tenure

The expiry date for PE578 is September 2021. Should production at Ruashi extend beyond this date, an application to renew this exploitation permit would need to be submitted timeously according to the DRC Mining Code. Metorex reports that necessary applications will be made 6 months in advance as per the DRC Mining Code.

3.19.2 Mineral Resources

SRK is of the opinion that there are risks associated with the quality of the estimates compared to the input data. The Indicated Mineral Resource classification over a localised portion of the north-west of Pit I is not supported by the limited drill hole coverage, but this represents a small proportion of the total Indicated Mineral Resources. There is limited data at depths below 1 160 m elevation.

Metorex accepts these comments and will be addressing them by diamond drilling in H2-F2013 and F2014.

3.19.3 Rock Engineering

SRK is concerned that the rock engineering properties of the saprolites are not fully quantified or understood. To improve confidence in the analysis and to identify possible anomalous areas within the slopes, there remains the necessity to collect good quality information on the nature and distribution of the saprolitic materials which form the upper portion of the slopes. This can be achieved with a combination of geotechnical drilling and face mapping. Attention will need to be given to maximise core recovery, so that the weaker materials are also recovered in the drill core.

The stability of slopes in saprolites is very sensitive to changes in ground water pressure. To confirm the pore pressure assumptions used in slope design and to develop an understanding of the pore pressure characteristics in relation to both time and excavation rate, it is recommended that a geohydrological investigation is implemented.

3.19.4 Hydrogeology

Contamination of groundwater has been identified as a significant risk. Pollutant concentrations have increased by 3 to 10 times from the background concentrations measured away from the TSF. Post mine closure predictive modelling indicates that the groundwater system will not recover to pre-mining background water quality and seepage will require treatment as the system will not recover naturally. Metorex reports that it has drilled a fence of drill holes around the TSF and equipped these with pumps to pump low pH water back to the TSF for neutralisation with lime.

The general observed long-term trend is declining water levels since 2010, due to dewatering from the pits. As far as could be ascertained from the KLMCS report, no predictions were done regarding predicted groundwater level drawdown around the Ruashi Mine (i.e. radius of cone of depression). Metorex maintains that whilst the water drawdown had not been predicted Ruashi Mine is currently supplying water to the surrounding communities from the on-site boreholes.

3.19.5 Mining

The limited space for waste material requires that Metorex's waste dumping strategy has to be carefully managed.

The successful blending of ore to the mill is dependent on effective grade control procedures and implementation of a sophisticated truck dispatch / material tracking system. Inefficiencies in such systems are a concern and could negatively influence profitability.

The availability (or lack) of skilled personnel required to implement and operate sophisticated procedures is of concern.

3.19.6 Mineral Processing

Metorex has provided for the installation of 15 MW of diesel-generated power to supplement the power supplied by SNEL. The Caterpillar diesel generators will be commissioned in August 2013. The Agrekko generators with a capacity of 13 MW that were on lease will be purchased during H2-F2013 and this will further decrease the dependence on SNEL. Nevertheless, the forecast production levels may be optimistic as these production levels have not been previously achieved.

Co recovery in H1-F2013 was only 67.7%. If the poor Co recovery in March 2013 is excluded, the Ruashi Mine exceeded the target 71% Co recovery in H1-F2013.

Power dips affect the availability of SO_2 and the supply of steam to the dryers. Metorex reports that the SO_2 and acid plant is connected to the back-up power supply therefore the risk in non-production due to power dips is mitigated.

The forecast production levels are based on successful debottlenecking of the plant, sustaining a 92% running time, and the successful operation of the SO_2 plant.

Sale of acid is dependent on the continuation of the off-take agreements.

The inventory of diesel will need to be carefully managed, given the delays through the border and the increased demand for power generation. Metorex has entered into a 12-month diesel supply agreement. Metorex has received written confirmation that the suppliers will be able to meet the increased diesel demand due to running 20 diesel-powered generators.

The commissioning of the diesel-generator sets in F2013 will effectively make Ruashi self-sufficient in terms of power supply, thereby minimising the effects of the power interruptions that plagued production in F2012. As SNEL power becomes more reliable with the interventions by mining companies in the DRC, Ruashi's reliance on diesel-generated power will reduce with accompanying reduction in operating costs.

3.19.7 Engineering and Surface Infrastructure

The main issue faced by Ruashi mine has been the poor availability of electricity in the region, coupled with an unstable supply when it is available. This is compounded further by the premature failures to electrical equipment such as motors, VSD drives, control and instrumentation equipment. The internet communications and IT-based equipment also suffers with damage due to the power supply issues. The mine has increased the installed diesel generation capacity on site to around 23 MW, which has drastically reduced the mine's reliance on SNEL and ZESCO for power. The introduction of the Agrekko diesel generators has drastically improved electrical power availability to the site.

The planned maintenance system needs to be refined to improve the engineering department's ability to report on equipment costs and work history. Presently unplanned job cards are not religiously completed, but the CMMS upgrade plans are in place and work is underway by Metorex to include unplanned job cards in the reporting structure going forward.

3.19.8 Logistics

Possibly the highest logistics risk that Ruashi Mine faces is the extended periods that road vehicles have to endure at the DRC-Zambia border crossing point, especially the fuel (diesel) vehicles, necessary to power the mining fleet and the diesel powered generators. Metorex had initiated a tender process to secure sufficient diesel for the generators. Metorex has received written confirmation that the suppliers will be able to meet the increased diesel demand due to running 20 diesel-powered generators.

Diesel supply and inventory control have been demonstrated during Q2 2013.

3.19.9 Human Resources

There is a risk that the termination benefit at closure which has been set equal to a 6 month obligation may be understated. Metorex reports that the termination benefits are reviewed on an annual basis to ensure that adequate provision and funding are in place. Any annual adjustment will not be material to the overall group.

3.19.10 Occupational Health and Safety

The safety statistics reflect the standards of safety, maintenance, repairs and operations seen on site at the Ruashi Mine operations. Given the observations made by SRK during its visit to the EW section, it does tend to suggest that there is a worker behavioural issue that is impacting on safety performance. Metorex referred to this as the "cultural tolerance to risk".

The risk is that if the work based auditing and planned task observation processes carried out by management and supervisors are not maintained, safety standards may slip. Metorex has advised SRK that management continues to concentrate its efforts on employees' behavioural attitude towards safety and health in the work place.

3.19.11 Environmental

The Equator Principles audit undertaken in 2011 identified the management of ground and surface water resources as the key environmental challenge facing the Ruashi Mine. The audit was repeated in 2012 but this conclusion remains applicable, although it is noted that significant progress has been made in addressing issues from the 2011 audit.

The risks associated with the closure cost estimate include:

- The possibility of ongoing long term water treatment post closure;
- Unexpected social costs due to community expectations being enforced.
- Closure related environmental, social and economic risk identification; and
- Provision for aftercare, maintenance and monitoring. (There is provision for this in the closure cost estimate by Steadman but it is possible, especially in the light of the fact that a contaminated ground water plume potentially represents the single biggest environmental risk, that the provision is inadequate.)

The Ruashi Mine is faced with several social challenges / issues related *inter alia* to poverty in the area, poor basic infrastructure in communities, high community expectations and government scrutiny. The mine is involved in several Corporate Social Responsibility projects in the areas of education, health, infrastructure, potable water and power. These projects, which are co-ordinated by a committee on which the mine, the mayoral office, the water and electricity utilities and local chiefs are represented, are continuing.

Metorex has been alerted to the potential shortcomings of its current closure planning and an action plan has been developed to mitigate their effects.

Metorex has a group-wide provision for post-closure water treatment of around USD5 million. In SRK's experience, this figure is likely to be considerably more. SRK has in agreement with Metorex increased this provision for post closure water treatment to USD25 million for the group for evaluation purposes, of which USD10 million is allocated to Ruashi. The additional provision does not eliminate this risk, but it reduces the potential financial impact on the company significantly.

Interpretation of on-going water monitoring results will assist in the investigative work required to assess the likelihood and extent of the post closure water treatment being required.